WORKFORCE NEEDS ASSESSMENT

OF MISSOURI'S FOOD, AGRICULTURE AND FORESTRY INDUSTRIES

JULY 2020

Extension
University of Missouri

MISSOURI dept. of Agriculture

Missouri Agricultural Foundation

MASBDA
MISSOURI AGRICULTURAL AND SMALL BUSINESS DEVELOPMENT AUTHORITY

Missouri Agricultural Foundation

10 July 2020

The Missouri Agricultural Foundation is pleased to share the Missouri Food, Agriculture and Forestry Workforce Needs Assessment. Conducted by University of Missouri Extension, this assessment highlights the jobs that food, agriculture and forestry employers must fill over the next decade and their priority workforce challenges.

The study found that most food, agriculture and forestry occupations do not require post-secondary education, so preparing this workforce involves more experiential learning. This makes workers with basic work readiness, supervisory and problem solving skills critical. Employers identified finding workers with basic skills as one of their most pressing workforce challenges. Employers need to fill jobs unique to food, agriculture and forestry (e.g., agricultural equipment operators), but they also compete with employers in sectors such as construction to fill jobs demanded throughout the economy (e.g., truck drivers).

Preparing this future workforce will require collaboration between private sector, government and educational leaders to:

- Further promote careers in food, agriculture and forestry and career and technical education to students and new workers,
- Convene employers, educators and key support organizations to develop and execute strategies that address specific workforce challenges, and
- Raise awareness and use of existing workforce programs and services among food, agriculture and forestry businesses.

The ongoing economic consequences of COVID-19 remain unknown, and therefore long-term planning is challenging. However tackling these workforce challenges remains an important priority, and this report will provide the foundation for a long-term workforce development strategy for Missouri's food, agriculture and forestry workforce in 2021.

We express our gratitude to the private sector, state government, and higher education leaders who participated in this project's steering committee and provided valuable feedback. We would also like to thank the many Missourians who shared their knowledge by completing the project's employer survey and/or attending stakeholder interviews and focus groups.

We hope Missourians involved in food, agriculture and forestry can use the information in this report to grow and strengthen the state's workforce. Direct questions about the project to Dr. Mark C. White (whitemc@missouri.edu), Associate Extension Professor, University of Missouri Extension.

Sincerely,

Leon Busdieker

Leon Busdieker

Board President, Missouri Agricultural Foundation

ACKNOWLEDGEMENTS

This report was made possible by a grant from Missouri Agricultural and Small Business Development Authority and support from the Missouri Agricultural Foundation and the Missouri Department of Agriculture.

The authors would like to thank the leaders from private sector, state government, and higher education that formed the project steering committee for the generous contribution of their time and feedback. We would also like to thank the many people across Missouri who took the time to promote and/or complete our employer survey and participate in stakeholder interviews and focus groups.

This project was completed by University of Missouri Extension under the leadership of Dr. Mark C. White.

Authorship:

- Mark C. White, PhD, Associate Extension Professor; State Specialist, Labor and Workforce Development; Interim Director, Institute of Public Policy, Truman School of Public Affairs.
- Mallory Rahe PhD, Assistant Extension Professor, Exceed.
- Ryan Milhollin, Extension Specialist, Agricultural Business and Policy.
- Joe Horner, Extension Specialist, Agricultural Business and Policy.
- Robert Russell, PhD, Assistant Extension Professor; State Specialist, Labor and Workforce Development.
- Jennifer Presberry, Senior Coordinator for Business and Communities Extension.
- Maria Kuhns, Exceed Graduate Research Assistant.

The survey was completed with the assistance of Bridget Murphy from the University of Missouri's Assessment Resource Center.

Technical inquiries can be directed to Dr. Mark C. White (whitemc@missouri.edu).

CONTENTS

EXECUTIVE SUMMARY

Missouri's large and diverse agricultural sector is foundational to the state's economy. According to an analysis of Missouri's agriculture and forestry industries, the sector contributed over $88 billion to the state's economy in 2016—approximately 15 percent of total state output.[1] As the global demand for food continues to rise, the State of Missouri has an ambitious goal of doubling its agricultural production over the next thirty years. Achieving this goal will require multiple strategies, including the development of a next-generation agricultural workforce.

Tackling the state's food, agriculture and forestry-related workforce challenges remain an important priority even though the ongoing economic consequences of COVID-19 remain unknown. This assessment draws on an analysis of labor market information, employer surveys, and key informant interviews. Combined, this research highlights the jobs that these employers need to fill over the next decade, and identifies the current and future workforce challenges they face. The report findings will inform the creation of a long-term workforce development strategy for Missouri's food, agriculture and forestry workforce.

Missouri's food, agriculture and forestry workforce.

In 2019, there were over 107,000 direct ***wage and salary*** jobs[2] in the 98 food, agriculture and forestry NAICS (North American Industrial Classification System) industries included in this study (a complete list of these industries is in Appendix B). These industries fall into four different categories:

- Production agriculture—12,500 jobs[3] in 17 NAICS industries.
- Agricultural support and services—32,600 jobs in 14 NAICS industries.
- Food and beverage manufacturing—47,500 jobs in 47 NAICS industries.
- Forestry and wood products manufacturing—14,600 jobs in 20 NAICS industries.

Total wage and salary employment in 2019 was only slightly higher than in 2001 (106,500) due to the job losses that occurred during the last recession, particularly in forestry and wood products manufacturing. Surveys and interviews conducted during the first two months of 2020 revealed that most employers anticipated stability or slow growth, prior to the onset of the COVID-19 pandemic and the subsequent economic shock. The severity and duration of these economic shocks remains to be seen, but since food is a relatively inelastic good, we can assume that employment will remain steady over the long-term.

[1] Economic Contributions of Missouri Agriculture and Forestry**.** Prepared by Decision Information Solution, December 2016.
[2] Wage and salary workers are employees that receive wages, salaries, commissions, etc. from their employers for their work. This employment is often referred to as a 'covered employment' because workers in these jobs are covered by the unemployment insurance (UI) program. This is the primary way that the US Bureau of Labor Statistics measures employment, as their data are drawn from the UI program's administrative records.
[3] We recognize that there are significant numbers people involved in production agriculture that do not hold wage and salary jobs. For instance, data from the US Bureau of Economic Analysis, shows that there were approximately 86,500 farm proprietorships in the state of Missouri in 2018. Moreover, the US Census Bureau's non-employer statistics—which counts businesses with no paid employees and receipts greater than $1,000 per year—showed that Missouri had roughly 6,000 non-employers in non-farm agricultural support activities, 7,700 non-employers in landscaping services, and over 700 non-employers each in both food manufacturing and wood products manufacturing in 2017. Nevertheless, this report focuses on the occupations within firms that have employees.

Over the past 20 years, the vast majority of job openings in food, agriculture and forestry has been the result of turnover (workers leaving or aging out of jobs), rather than growth. Over the next decade, these industries are projected to generate 13,000 annual openings.[4] For many of these jobs, relatively lower wages may contribute to this turnover. The state median hourly wage for all occupations is $17.88 ($37,200 annually)[5], and roughly 70 percent of the wage and salary jobs in food, agriculture and forestry pay $18 per hour or less.

In aggregate only one out of every eight jobs (12 percent) in food, agriculture and forestry typically require some kind of post-secondary degree or certification, but many jobs need workers with extensive training and experience. Nearly 40 percent of food, agriculture and forestry jobs typically require workers to have moderate (1 month to 1 year) or long-term (more than 1 year) on-the-job training (OJT); a figure double the state share of jobs requiring similar levels of experience and OJT.

Industry staffing patterns allow us to determine patterns of occupational demand, which in turn enables us to identify occupations unique to food, agriculture and forestry, and occupations in-demand throughout the economy. For instance, food, agriculture and forestry-related industries employ more than 90 percent of the state's veterinarians, but less than 5 percent of Missouri's heavy and tractor-trailer truck drivers. This distinction is an important consideration for developing broader workforce strategies. Unique occupations require strategies that ***create*** workers to fill these jobs (e.g., engaging students, providing specialized training and education). By contrast, hiring for more in-demand occupations necessitates strategies that better position food, agriculture and forestry employers to ***compete*** for workers capable of filling these positions.

Food, agriculture and forestry employs a diverse set of occupations.

The diverse nature of activities in food, agriculture and forestry means that employers need workers who can perform a wide range of tasks. The tables below highlight the occupations with the most projected annual openings based on typical education requirements.

- Figure A shows that the greatest number of projected annual openings are for jobs that typically require lower and semi-skilled workers, and also have relatively low annual earnings.
    - Many of these occupations involve manual labor specific to industries such as landscaping services, meat processing or production agriculture.
    - Employers in other manufacturing sectors as well as distribution and logistics employ workers in similar occupations (e.g., hand packers and packagers; and first-line supervisors); food, agriculture and forestry employ from the same labor pool and therefore compete with these other sectors.

[4] Unless noted otherwise, the analysis uses Economic Modeling Specialists International (EMSI) representation of U.S. Bureau of Labor Statistics data. The EMSI data combine U.S. Bureau of Labor Statistics employment payroll data from its Quarterly Census of Employment and Wages. EMSI then estimates data where BLS privacy standards do not allow it to disclose publicly. These estimates allow us to get greater industry and geographic data.
[5] US Bureau of Labor Statistics, Occupational Employment Survey, May 2019.

Figure A: Common lower and semi-skilled occupations in food, agriculture and forestry (Min. 200 projected annual openings)

Occupation	2019 FAF Jobs	2019 Jobs in Missouri	Avg. Annual FAF Openings (19-29)	Median Annual Earnings	Create v. Compete	Prod. agriculture	Agri. support & services	Food & beverage MFG	Forestry & wood products MFG
Landscaping & groundskeeping workers	9,277	16,836	1,192	$29,016	Create		X		
Crop, nursery, & greenhouse farmworkers & laborers	3,921	4,296	644	$26,354	Create	X			
Meat, poultry, & fish cutters & trimmers	4,105	4,623	553	$29,702	Create			X	
Hand laborers & freight, stock, & material movers	3,232	47,227	490	$28,891	Compete		X	X	X
Veterinary assistants	2,036	2,285	348	$26,957	Create		X		
Farm, ranch, & aquacultural animals farmworkers	1,835	2,393	289	$28,080	Create	X			
Helpers--production workers	1,661	6,119	274	$29,266	Compete			X	X
Hand packers & packagers	1,599	9,353	264	$24,606	Compete	X		X	X
Industrial truck & tractor operators	2,123	12,479	259	$34,112	Compete			X	X
First-line spvrs. of production & operating workers	2,265	13,324	249	$56,098	Compete			X	X

Source: Economic Modeling Specialist, Int'l (2019.4)

- Figure B shows that there are relatively fewer openings for jobs that require higher levels of training and experience, but not necessarily post-secondary education.
  - These occupations tend to require workers with greater experience (e.g., machine operators), ability to work independently (e.g., agricultural equipment operators, sales), and problem-solving skills (e.g., maintenance and repair, farm equipment mechanics and service technicians, and industrial machinery mechanics).
  - Workers with these skills are in-demand throughout the workforce, but given the specialized knowledge require to perform these jobs training remains a priority.

Figure B: Common middle-skill occupations in food, agriculture and forestry (Min. 100 projected annual openings)

Occupation	2019 FAF Jobs	2019 Jobs in Missouri	Avg. Annual FAF Openings (19-29)	Median Annual Earnings	Create v. Compete	Prod. agriculture	Agri. support & services	Food & beverage MFG	Forestry & wood products MFG
Food batchmakers	5,294	6,355	764	$33,176	Create			X	
Packaging & filling machine operators	5,238	10,506	651	$32,656	Create			X	
Paper Goods machine operators	2,895	3,409	289	$43,410	Create				X
Sales reps., wholesale & MFG, except tech. & sci. products	2,008	25,444	217	$56,888	Compete		X	X	X
General maint. & repair workers	1,834	28,140	194	$36,150	Compete		X	X	X
Wood sawing machine operators	1,495	2,083	171	$24,856	Create				X
Inspectors, testers, sorters, samplers, & weighers	1,297	9,945	167	$39,416	Compete			X	X
Food cooking machine operators	1,132	1,353	163	$28,683	Create			X	
Farmers, ranchers, & other ag. mgrs.	1,902	1,929	158	$56,867	Create	X			
Woodworking machine operators, except sawing	1,261	1,929	147	$27,893	Create				X
Team assemblers	1,334	24,982	145	$36,504	Compete		X	X	X
Agricultural eqpt. operators	846	1,115	141	$30,992	Create	X	X		
Mixing & blending machine operators	884	2,563	117	$40,539	Compete		X	X	
Farm eqpt. mechanics & service techs.	1,155	1,402	111	$36,400	Create		X		
Separating, clarifying, precipitating, & still machine operators	991	1,381	110	$41,267	Create			X	
Industrial machinery mechanics	984	5,040	101	$52,582	Compete		X	X	X

Source: Economic Modeling Specialist, Int'l (2019.4)

- Figure C shows openings in occupations that typically require a post-secondary degree or certification are more limited in number.
    - Occupations such as veterinarians and agricultural and food science technicians are specialized and require extensive post-secondary education.
    - Food, agriculture and forestry employers need to attract workers to fill managerial and office and administrative support occupations. They must also compete with other industries to meet their need for truck-drivers.

Figure C: Common food, agriculture and forestry occupations that typically require post-secondary degrees or certifications (Min. 35 projected annual openings)

Occupation	2019 FAF Jobs	2019 Jobs in Missouri	Avg. Annual FAF Openings (19-29)	Median Annual Earnings	Create v. Compete	Prod. agriculture	Agri. support & services	Food & beverage MFG	Forestry & wood products MFG
Heavy & tractor-trailer truck drivers	2,092	45,123	248	$44,034	Compete	X	X	X	X
Veterinary technologists & techs.	1,479	1,605	146	$29,661	Create		X		
General & operations mgrs.	1,570	46,803	143	$81,494	Compete		X	X	X
Bookkeeping, accounting, & auditing clerks	910	29,536	104	$36,774	Compete	X	X	X	X
Veterinarians	1,469	1,599	76	$89,232	Create		X		
Industrial production mgrs.	510	3,422	42	$97,302	Compete		X	X	X
Accountants & auditors	416	25,473	41	$63,648	Compete	X	X	X	X
Agricultural & food science techs.	304	636	35	$38,771	Create	X		X	

Source: Economic Modeling Specialist, Int'l (2019.4)

Strengthening Missouri's food, agricultural and forestry workforce requires addressing several critical issues.

While many food, agriculture and forestry employers experience some challenges trying to find workers for specific occupations, there are also a number of cross-cutting challenges that must be addressed in order to build a next-generation workforce. These issues include:

- ***Encouraging new workers to consider careers in food, agriculture and forestry.***

  Exposing young workers to careers in food, agriculture and forestry is an important first step in constructing a talent pipeline. Organizations like 4-H and FFA are critical partners for promoting these careers for youth; 61 percent of survey respondents worked with these groups to promote careers in their industry. Agricultural education and career and technical education (CTE) programs also prepare students for these careers. However, not all students have access to these programs and retaining good teachers can prove challenging because the skills that make someone an effective agriculture or CTE teacher, also makes them qualified for more lucrative jobs in industry.

- ***Food, agriculture and forestry employers compete with other industries for workers of all skill levels.***

  Half (51 percent) of the survey respondents indicates that the most difficult skills to find were reliability and general work readiness. In many instances, these employers compete directly for workers with higher paying employers in construction and other manufacturing industries. Population loss—particularly in Missouri's rural counties—exacerbates these challenges by limiting the total

number of workers from which employers can draw; 53 percent of the state's food, agriculture and forestry jobs were located in the 76 Missouri counties that had net population loss between 2010 and 2019.

- ***Growing and maintaining a competitive workforce requires continued training and education.***

  In response to the lack of qualified applicants, 78 percent of survey respondents hired less experienced workers and provided subsequent training primarily through OJT. Large and small employers have different workforce needs, as well as different abilities to meet those needs. Survey respondents with more than 50 employees were more likely to partner with post-secondary institutions for customized training and/or apprenticeships, due to greater training resources and/or more specialized needs. There was also a stated need for stronger basic business skills (e.g., budgeting, pricing services, marketing, or succession planning), particularly in industries with many smaller businesses. These skills are vital for farms, landscaping businesses or veterinary offices to become viable enterprises.

- ***Greater use of automation and technology can alter workforce needs.***

  New technologies and automated processes can alleviate staffing pressures, but 40 percent of survey respondents could not afford to automate their processes; another 35 percent indicated that insufficient broadband capacity prevented them from using technologies such as labor-saving mobile applications. These technologies can change the demand for jobs by increasing productivity and reducing overall headcount, but it can also increase demand for more skilled workers (e.g. maintenance staff). The COVID-19 pandemic is accelerating trends toward greater adoption of automated processes, particularly in food manufacturing.

Moving forward.

Missouri's private sector, state government, and education leaders will use the information presented in this report to develop a long-term workforce development strategy for Missouri's food, agriculture and forestry industries. Even in an era of constrained public resources, these leaders can address the challenges described above through greater communication and collaboration, and taking steps to:

- Expand efforts to promote food, agriculture and forestry careers and technical education,
- Organize statewide or regional sector strategies related to food, agriculture and forestry,
- Promote existing workforce programs and services, and
- Invest in rural communities, and particularly their broadband infrastructure.

Developing a next generation workforce for Missouri's food, agriculture and forestry industries will not happen overnight. However, this transformation can occur with strategies that address both short-term challenges and long-term needs.

1. INTRODUCTION

Missouri's large and diverse agricultural sector is foundational to the state's economy. According to an analysis of Missouri's agriculture and forestry industries, the sector contributed over $88 billion to the state's economy in 2016—approximately 15 percent of total state GDP.[6] As the global demand for food continues to rise, the State of Missouri has an ambitious goal of doubling its agricultural production over the next thirty years.

The Show-Me-State Food, Beverage and Forest Products Manufacturing Initiative identified several opportunities for Missouri to grow the state's food, agriculture and forestry industries.[7] These opportunities include accelerating the development of regional food systems, building a more research and innovation-driven food system, and growing and enhancing the state's value-added processing activities for key commodities such as grains, dairy products, eggs and livestock. However, the study cites Missouri's lack of a skilled workforce—particularly in more rural regions—as a factor limiting the state's ability to take advantage of these opportunities.

Developing a next-generation agricultural workforce will require Missouri to find more effective ways to attract students and workers to careers such as laborers, technicians and professionals in food, agriculture and forestry-related industries; connect workers to relevant training and education opportunities; and utilize labor saving technologies and processes. These agricultural workforce challenges are not unique to Missouri, as states throughout the country face similar challenges. For instance, an examination of Kansas' agricultural workforce found that the lack of a skilled agriculture workforce was a top inhibitor of growth and expansion for many Kansas agricultural enterprises.[8] In Michigan, researchers found that the public lacked awareness not only about the scope of the state's food and agriculture industries, but also how technology was transforming agriculture and food processing.[9] In New York State, researchers found tight labor markets, difficulty in attracting new workers to agriculture, and challenges for smaller farm operators to adopt labor-saving equipment and technology.[10]

Tackling the state's food, agriculture and forestry-related workforce challenges remain an important priority even though the full economic consequences of COVID-19 remain unknown. This assessment highlights the jobs that Missouri's food, agriculture and forestry employers must fill over the next decade, and considers their current and future workforce challenges. Understanding these challenges will allow Missouri to more effectively undertake the longer-term planning necessary to address current and future challenges. In spite of the current uncertainty, many of these workforce challenges—attracting new workers to select careers in food, agriculture and forestry, improving access to relevant and timely training and education, and adopting and implementing

[6] Economic Contributions of Missouri Agriculture and Forestry**.** Prepared by Decision Information Solution, December 2016.
[7] Show-Me-State Food, Beverage & Forest Products Manufacturing Industry**.** Prepared by Teconomy Partners LLC, February 2019.
[8] Workforce Needs for the Agriculture Industry in Kansas**.** Prepared by the Kansas State University Agricultural Land Use Survey Center (ALUSC), 2015.
[9] ***Food and Agriculture Workforce Capacity-Building in Michigan: A Critical Examination.*** Prepared by the International Food Protection Training Institute, June 2015.
[10] The State of the Agricultural Workforce in New York**.** Prepared by Cornell College of Agriculture and Life Sciences and Charles H. Dyson School of Applied Economics and Management at Cornell University, March 2019.

new technologies and automated processes—are ongoing challenges, regardless of economic conditions. These issues must be addressed for Missouri to increase the overall productivity of its food, agriculture and forestry industries.

This report is organized as follows. After a brief review of our approach, we describe broad industry and occupational trends within food, agriculture and forestry. We then identify the common occupations within each segment of food, agriculture and forestry—production agriculture, agricultural support and services, food and beverage manufacturing, and forestry and wood products—as well as the specific challenges they face in filling those jobs. We subsequently examine the common challenges facing many food, agriculture and forestry employers. These challenges include encouraging new workers to consider careers in food, agriculture, and forestry, competing with other industries for manual and skilled labor, maintaining a competitive workforce through training and education, and adopting new technologies and automated processes. We conclude by identifying several areas for future action.

OUR APPROACH

This workforce needs assessment study used multiple methods—analysis of labor market information, an employer survey and industry and stakeholder focus groups and interviews—to assess the current and future needs of Missouri's food, agriculture and forestry industries. Appendix A has a more complete description of the research underpinning this study.

The 2016 Economic Contributions of Missouri Agriculture and Forestry report provided an initial NAICS (North American Industry Classification System) based definition of food, agriculture and forestry, as well as the four industry segments (production agriculture, agricultural support and services, food and beverage manufacturing, and forestry and wood products). Appendix B includes employment trends for the 98 selected NAICS industries considered in this study.

That study sought to account for the full range of economic impacts associated with a given industry or set of industries, but this study has a different goal. Rather, it seeks to understand the demand for workers and how employers can meet that demand. As a result, this analysis focuses primarily on ***wage and salary jobs***—jobs found in firms with employees. By focusing on these jobs, we can make assumptions about the current and future staffing needs of the employers in our defined set of industries.

Industry data (NAICS) can tell us what companies make (e.g., dairy product manufacturing), but we need occupational data—based upon the Standard Occupational Classification (SOC) system—to better understand what employers need workers to do (e.g., agricultural equipment operators, veterinarians). The US Bureau of Labor Statistics' industry-occupation staffing pattern matrix helps identify the common occupations in each segment of Missouri's food, agriculture and forestry industries, as well as these occupations' employment levels (wage and salary jobs), projected annual openings, average earnings, and typical educational requirements. We used employment data and projections from Economic Modeling Specialists International (EMSI), a nationally-recognized, proprietary vendor of labor market information.

In addition to the labor market information, we also conducted a survey of Missouri's food, agriculture and forestry employers. The survey covered a range of priority topics, such as current vacancies and firm growth trends, recruitment and retention practices, training and skill development, and automation. The survey received responses from over 300 employers between January 6, 2020 and March 15, 2020. The complete survey can be found in Appendix D.

The project team also sought employer and stakeholder input through a series of interviews and focus groups. In total, the project team spoke to over 70 employers and key stakeholders. These conversations were vital to the research, as they allowed us to better interpret and validate the quantitative research findings as well as better understand issues not readily apparent in the data.

2. CHARACTERISTICS OF MISSOURI'S FOOD, AGRICULTURE AND FORESTRY WORKFORCE

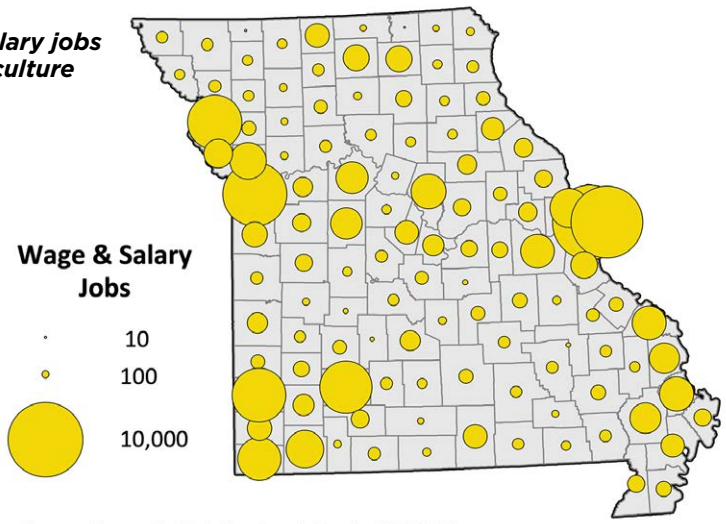
Several contextual factors shape the demand for labor in Missouri's food, agriculture and forestry industries. First, wage and salary employment has remained relatively steady in the combined 98 NAICS industries included in this study. As a result, the level of demand should remain consistent over the long-term. These diverse activities generate jobs in a wide variety of occupational categories. Many of these jobs, however, pay relatively lower wages and require more training and experience than post-secondary education. This occupational information further allows us to identify the most common jobs in food, agriculture and forestry, and what other industries employ large numbers of similar workers. This section reviews these broad industry and occupational trends in greater detail.

2.1 Food, agriculture and forestry industry trends

In 2019, there were over 107,000 direct ***wage and salary*** food, agriculture and forestry jobs across Missouri.[11] These activities are defined by their diversity. Within the agricultural sector, Missouri farmers produce crops such as soybeans, corn, wheat, rice, cotton, vegetables, fruits and nuts. Missouri farmers also raise beef cattle, dairy cattle, swine, poultry, and goats. These production activities feed in to significant processing activities led by larger firms such as Triumph Foods, Cargill, ADM, Tyson, Georges, Smithfield, and Kraft that employ thousands of Missourians, as well as smaller specialty food manufacturers such as Jasper Products, Burger's Smokehouse, Italgrani and Paradise Meats among others. Missouri is also home to globally-recognized food manufacturers such as AB InBev and Nestle Purina Petcare. Forestry and wood products companies employ many workers—particularly in Southern Missouri—in small sawmills, railroad tie production, pallet mills, hardwood flooring mills and in stave and cooperages.

Food, agriculture and forestry employers create jobs throughout Missouri.

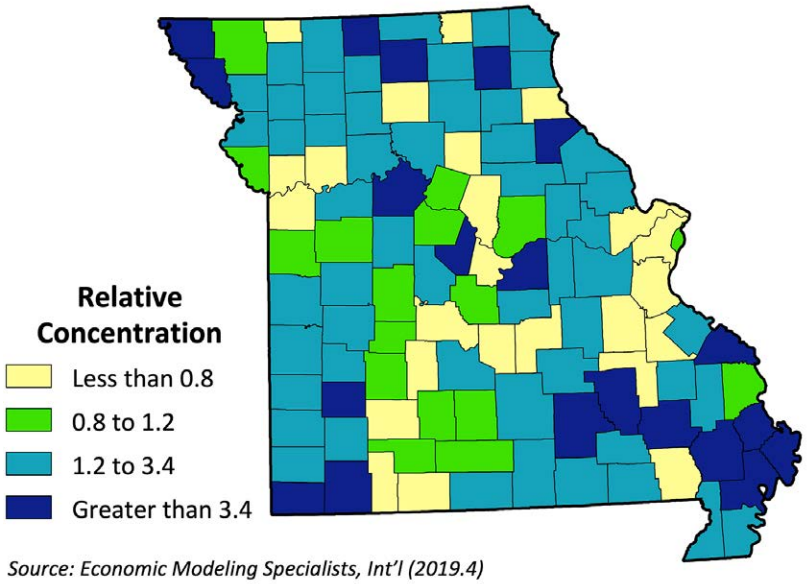
Figure 1: Wage and salary jobs in food, agriculture and forestry



Source: Economic Modeling Specialists, Int'l (2019.4)

[11] This total is based on the wage and salary employment in the 98 selected NAICS industries considered in this study.

Figure 2: Relative concentration of wage and salary jobs in food, agriculture and forestry



Source: Economic Modeling Specialists, Int'l (2019.4)

Figure 1 shows the geographic distribution of these wage and salary jobs throughout the state. The majority of these jobs (65 percent) are in metro counties where 75 percent of the state's population lives. This includes the counties of the St. Louis and Kansas City metro areas, as well as smaller metro areas such as St. Joseph and Joplin. Relatively large numbers of food, agriculture and forestry-related employment is also found in non-metro counties like Barry, Scott, and Perry counties.

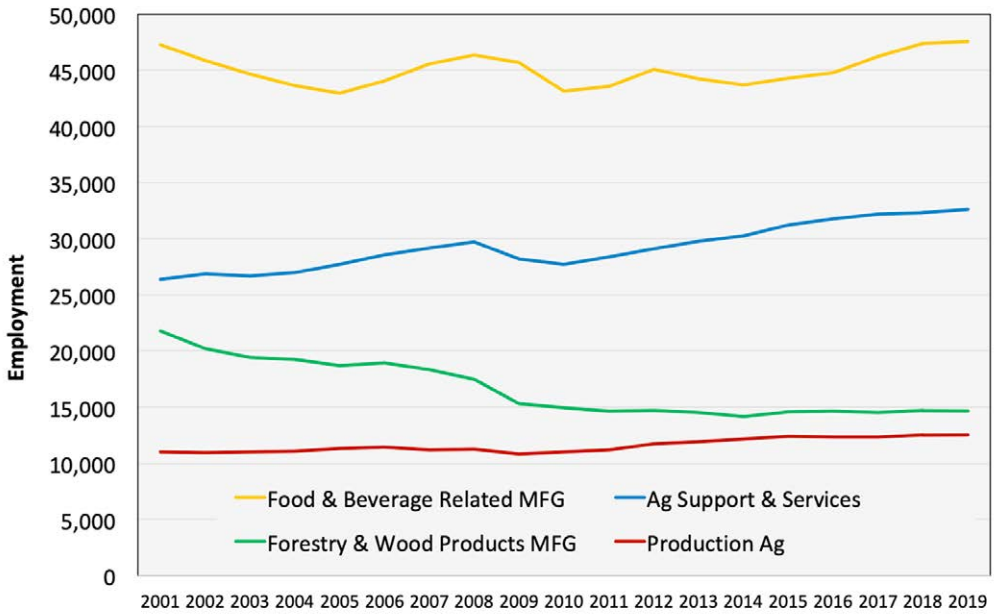
The majority of these jobs are in metro counties, but these activities remain vital to the state's rural counties. Figure 2 shows the concentration of these jobs, relative to the share of these jobs within the national economy.[12] Food, agriculture and forestry jobs are most concentrated in counties like Sullivan and McDonald, where large processors (e.g., Smithfield in Milan and Tyson in Noel) represent a significant share of those county's total employment. Consequently, any changes to these plants' employment can have significant consequences for the local economy.

Employment varies by industry segment, but total jobs remained stable.

Figure 3 shows employment trends in Missouri's food, agriculture and forestry industries since 2001. Total wage and salary employment in 2019 (107,350) was only slightly higher than it was in 2001 (106,500) due to the job losses that occurred during the last recession, particularly in forestry and wood products manufacturing. That said, food, agriculture and forestry-related industries experienced stronger growth over the past five years. Between 2014 and 2019, these industries added approximately 7,000 net new wage and salary jobs. This growth represents a compound annual growth rate of 1.4 percent, a rate faster than Missouri's wage and salary job growth (1.2 percent) during the same period.

[12] We measure relative concentration using location quotients (LQ), which measure the relative percentage of a state or region's industry employment, as compared with the national employment share. An LQ greater than 1.0 means that the region has a larger relative concentration of industry employment than the overall national economy. Furthermore, if the industry's LQ is growing over time, then industry employment is becoming more concentrated in the region; this suggests an improvement in the region's relative competitiveness.

Figure 3: Wage and salary employment trends in food, agriculture and forestry



Source: Economic Modeling Specialists, Int'l (2019 Q4)

Between January and early March of 2020, 43 percent of survey respondents indicated that they expected their employment to increase slightly over the next 12 months, and another 43 percent said it would stay the same. Consequently employers anticipated stability, or perhaps slow growth, prior to the onset of the COVID-19 pandemic and the subsequent economic shock. However, at the time of this writing (March-April 2020), it is particularly difficult to project the future outlook for these industries. The severity and duration of the impact of COVID-19 on the economy remains uncertain.

Looking at the employment trends during the most recent recession may provide some insight into longer term trends. Figure 3 shows that wage and salary employment within production agriculture remained relatively steady over the past two decades including during the last recession. Food tends to be a relatively inelastic good, whereby people buy similar amounts of food in good and bad economic times. As a result, we can likely expect that wage and salary employment within production agriculture will remain relatively consistent over the long-term.

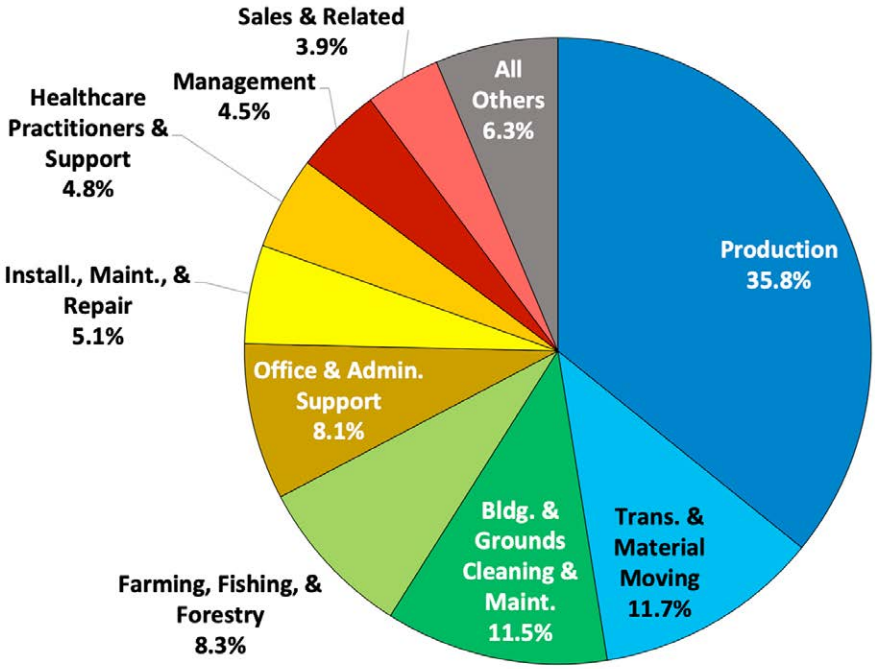
Food manufacturing lost employment during the last recession, but not nearly as much as much as the state's overall manufacturing sector. Between 2008 and 2010, Missouri's food and beverage manufacturing employment declined by 7 percent, while Missouri's overall manufacturing employment declined by 16 percent during the same period. However, the same cannot be said for forestry and wood products manufacturing which lost employment at a rate consistent with the manufacturing sector overall. Since those losses, forestry and wood products employment has stabilized and established a new normal level of employment. It remains uncertain as to whether this set of industries rebounds to this level or takes another permanent dip after the pending recession.

Agricultural support and services has a different dynamic than the manufacturing-oriented industry segments. Its largest individual industries are landscaping services and veterinary services. In spite of their relevance to food, agriculture and forestry, both industries tend to be locally-serving. A prolonged recession may change some of the demand for these services (e.g., people are more willing to mow their own lawn, less likely to seek veterinary services for pets), but industry growth often reflects demographic trends; an increase of people leads to an increase in demand, and vice versa. Given that Missouri is a relatively low population growth state, we can therefore assume that once we return to more normal economic times these industries will experience slow, but steady growth.

2.2 Broad patterns of occupational demand

Food, agriculture and forestry industries employ workers from a broad set of occupational groups, and therefore have a wide array of workforce needs. Figure 4 shows the share of wage and salary employment by occupational category. Wage and salary jobs in farming, fishing and forestry occupations (e.g., farmers) represent 8.3 percent of the occupations in our defined set of industries. By contrast, manufacturers—especially food manufacturers—generate the majority of jobs in food, agriculture and forestry, and production occupations account for more than one-third (36 percent) of these jobs. Transportation and material moving occupations (e.g., truck drivers) further contribute another 12 percent of food, agriculture and forestry jobs, and are employers in all segments of food, agricultural and forestry—production agriculture, agricultural support and services, food manufacturing, and wood products manufacturing.

Figure 4: Food, agriculture & forestry employment* by occupational group (2019)



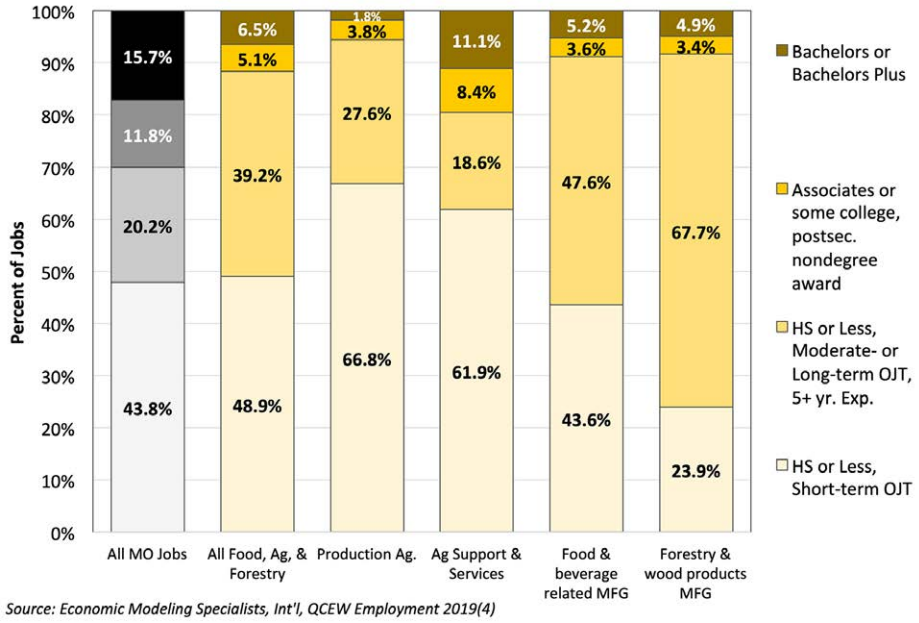
*Source: Economic Modeling Specialists, Int'l (2019.Q4), *Wage & Salary*

Most food, agriculture and forestry jobs require significant training and experience, more so than post-secondary education.

In aggregate, about half (49 percent) of the occupations within Missouri's food, agriculture and forestry typically require a high school degree or less and less than one month of on the job training (OJT). This is largely consistent with Missouri's overall workforce where 44 percent of jobs typically require similar levels of education and training. Due to the nature of the work, food, agriculture and forestry activities often demand workers with relatively more extensive OJT and experience. Figure 5 shows that nearly 40 percent of food, agriculture and forestry jobs typically require a high school degree or less, but workers tend to have moderate (1 month to 1 year) or long-term (more than 1 year) OJT; a figure double the state share of jobs requiring similar levels of experience and OJT. Only 12 percent of jobs in food, agriculture and forestry require some kind of post-secondary degree or certification.

Only 12 percent of jobs in food, agriculture and forestry typically require some kind of post-secondary degree or certification.

Figure 5: Share of wage & salary jobs by typical entry-level education (2019)



Source: Economic Modeling Specialists, Int'l, QCEW Employment 2019(4)

Production agriculture and agricultural support and services employ greater proportions of lower skilled labor (HS or less, short-term OJT) due in part to the large proportion of farm laborers and landscaping and grounds keeping workers, respectively. By contrast, occupations in food and wood products manufacturing often require more extensive OJT (e.g., machine operators, maintenance). The occupations requiring a post-secondary education relate to specialized occupations like veterinarians, business and management occupations, or truck drivers that require a certification (e.g., Commercial Drivers' License). As a result, workforce development efforts for much o f the food, agriculture and forestry workforce must focus more on training than education.

Some jobs are specific and unique to food, agriculture and forestry, but others are in-demand throughout the economy.

Industry staffing patterns allow us to identify occupations found predominantly in Missouri's food, agriculture and forestry-related industries, and occupations in-demand throughout the economy. Figure 6 shows common food, agriculture and forestry occupations sorted by typical entry-level education. If half of the total employment in a given occupation is in food, agriculture and forestry-related industries, we consider those jobs unique to those industries. For example, 63 percent of Missouri's food scientists and technologists work in our defined set of 98 food, agriculture and forestry industries. By contrast, these employers employ almost 2,100 heavy and tractor-trailer truck drivers, but this total represents just over 4 percent of total jobs in this occupation statewide.

Food, agriculture and forestry employers must create workers to fill jobs unique to these industries; they must also compete for workers to fill jobs demanded throughout the economy.

The relative uniqueness of each occupation within the food, agriculture and forestry-related industries is an important consideration for developing broader workforce strategies. Occupations unique to these industries necessitate strategies that ***create*** workers to fill these jobs by engaging students or providing specialized training and education. Conversely, food, agriculture and forestry employers must also recognize that they ***compete*** for talent with other industries throughout their region, the state and the nation. In these instances, employers must have strategies to effectively promote their job opportunities, and ensure that their compensation and benefits are competitive within the marketplace.

Figure 6: Common occupations unique to food, agriculture and forestry and throughout the economy

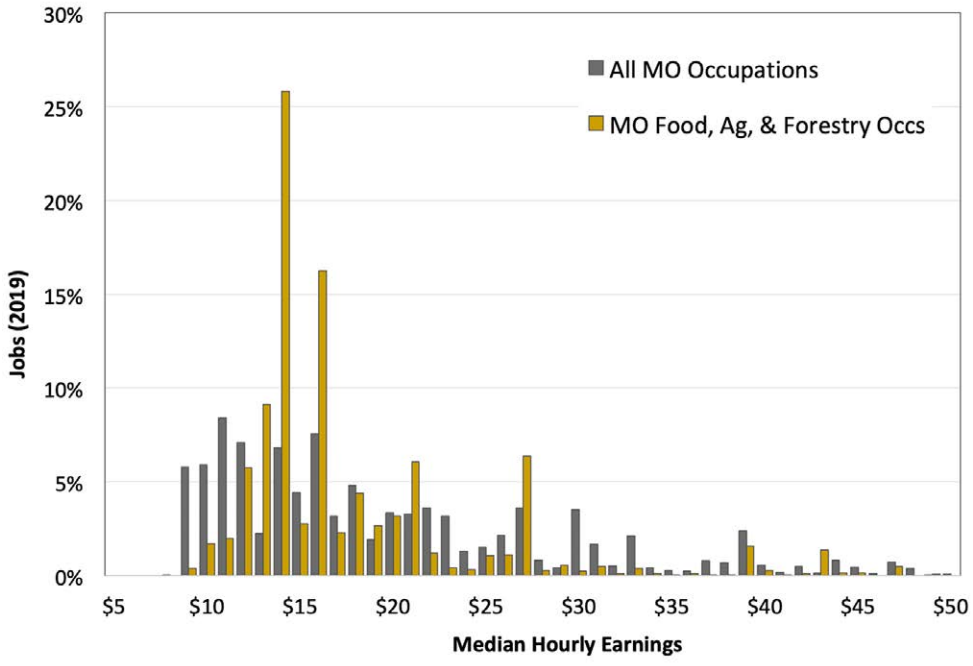
Typical Entry Level Education	Unique to Food, Agriculture & Forestry industries ('Create')	In-demand throughout the workforce ('Compete')
High School or less; Short-term OJT	• Lands. & grounds keeping workers • Meat, poultry, & fish cutters & trimmers • Farmworkers & laborers (crops & animals) • Vet. assts. & lab. animal caretakers	• Hand laborers & freight, stock, & material movers • 1st line spvrs. of production workers • Industrial truck & tractor operators
High School or less; Medium- or Long-term OJT	• Food batchmakers • Packaging & filling machine operators • Sawing machine operators • Farm eqpt. mechanics & service techs. • Agricultural eqpt. operators	• General maintenance & repair workers • Assemblers & fabricators • Wholesale & MFG sales representatives • Industrial machinery mechanics
Associates or some college, postsec. non-degree award	• Veterinary technicians • Agricultural & food science technicians	• Heavy & tractor-trailer truck drivers • Chemical technicians • Industrial engineering technicians • HR assistants
Bachelor's or Bachelor's Plus	• Veterinarians • Food scientists & technologists	• General & operations mgrs. • Industrial production mgrs. • Accountants & auditors • Industrial engineers

Median earnings reflect a heavy reliance on lower and semi-skilled labor.

Given that many occupations within Missouri's food, agriculture and forestry industries typically do not require post-secondary education, they often pay lower wages relative to other industries. Figure 7 shows the distribution of jobs by their median hourly earnings.[13] The state median hourly wage for all occupations is $17.88 ($37,200 annually)[14] , and roughly 70 percent of the wage and salary jobs in food, agriculture and forestry pay $18 per hour or less. Almost 45 percent of the wage and salary jobs in food, agriculture and forestry have median average earnings of $14 to $16 per hour; this translates into roughly $30,000 to $33,000 annually. Common occupations within this range of earnings include livestock farm laborers, meat cutters and trimmers, landscapers and groundskeepers, and veterinary technicians.

The food, agriculture and forestry occupations that pay higher median earnings often include supervisory or managerial responsibilities. For instance, farmers[15] and first-line production supervisors have median earnings of roughly $27 per hour. Occupations requiring more specialized knowledge and education pay higher wages; the median earnings for veterinarians and food scientists is almost $43 per hour and $29 per hour respectively.

Figure 7: Missouri's food, agriculture, and forestry wage & salary Jobs by median hourly earnings (2019)



Source: Economic Modeling Specialists, Int'l, QCEW Employment 2019(4)

[13] Earnings includes the value of both wages and benefits. However it is important to note that lower paying occupations typically provide fewer benefits, and as a result benefits typically represent a smaller proportion of total earnings in those lower paying jobs.

[14] US Bureau of Labor Statistics, Occupational Employment Survey, May 2019.

[15] Note that these are farmers who work on farms with wage and salary employees.

Since a large share of these jobs tend to have relatively low average earnings, food, agriculture and forestry employers regularly compete with other industries that employ similar kinds of workers. This may include other industries that employ manual laborers like distribution centers or other manufacturing industries, or in some instances other industries with large numbers of low-wage jobs like retail. Therefore, food, agriculture and forestry employers must be mindful of both the compensation offered by firms in their own industry, as well as firms in other industries that draw from the same labor pool.

3. OCCUPATIONAL DEMAND VARIES BY INDUSTRY SEGMENT

Over the next decade, there are projected to be 13,000 annual job openings in a wide array of food, agriculture and forestry-related occupations. An analysis of industry staffing patterns allowed us to identify the most common occupations within these industries. The specific occupations that employers must fill depends on the nature of their activities. To better understand this demand, this section will examine the most common occupations within each industry segment—production agriculture, agricultural support and services, food and beverage manufacturing, and forestry and wood products manufacturing.

Identifying these occupations allows us to present additional information such as the projected number of annual openings over the next decade or median annual earnings. It is important to note that the tables below give the occupational employment within *each industry segment*. Appendix C contains occupational data for the 112 individual occupations where there are at least 100 different jobs in the industries that comprise food, agriculture and forestry. These data, however, only tell part of the story. The sections below also highlight the challenges employers face in filling some of these specific positions, both now and in the future.

3.1 Production agriculture

Among establishments large enough to have wage and salary employees there were 12,500 wage and salary jobs in production agriculture in 2019.[16] Two industries—crop production and animal production—each contribute about 4,700 wage and salary jobs. Another 2,800 jobs are in industries such as postharvest crop activities and farm management services, among others. Within this set of industries, wage and salary employment has remained relatively steady over the past two decades.

Figure 8 highlights the specific occupations found in wage and salary jobs within production agriculture. Common occupations within these industries include farmers, farm managers, crop and livestock farmworkers and agricultural equipment operators. Several of these occupations such as farmers, farm managers and agricultural equipment operators typically require significant amounts of experience and OJT, even though some workers—particularly younger workers—have degrees.

[16] Missouri also has over 86,000 farm proprietors and another 6,000 non-employers in non-farming agricultural industries.

Figure 8: Common occupations within Missouri production agriculture

Occupation	Wage & Salary Jobs in Industry Segment (2019)	Total MO Wage & Salary Jobs	Proj. Avg. Annual Openings in Ind. Segment (19-29)	Median Annual Earnings
Jobs typically requiring post-secondary education or certification				
Heavy & tractor-trailer truck drivers	309	45,123	38	$44,034
General & operations mgrs.	78	46,803	8	$81,494
Agricultural & food science techs.	50	636	6	$38,771
Middle-skilled jobs				
Farmers, ranchers, & other agricultural mgrs.	1,892	1,929	157	$56,867
Agricultural eqpt. operators	754	1,115	125	$30,992
Bookkeeping, accounting, & auditing clerks	112	29,536	13	$36,774
General maint. & repair workers	106	28,140	12	$36,150
Packaging & filling machine operators	93	10,506	11	$32,656
Animal trainers	91	403	11	$26,666
Forest & conservation workers	67	335	14	$44,554
Unskilled & semi-skilled jobs				
Crop, nursery, & greenhouse farmworkers & laborers	3,826	4,296	627	$26,354
Farm, ranch, & aquacultural animals farmworkers	1,654	2,393	260	$28,080
All other agricultural workers	762	792	123	$28,462
First-line spvrs. of farming, fishing, & forestry workers	420	587	63	$46,134
Agricultural product graders & sorters	265	857	39	$26,998
Hand packers & packagers	186	9,353	32	$24,606

Source: Economic Modeling Specialist, Int'l (2019.4)

Other common occupations include crop and animal farmworkers which have relatively lower average earnings, and rely on lower and semi-skilled workers. Given the level of manual labor and the seasonality—particularly among crop farmworkers—these occupations tend to have greater employee turnover. Projected job openings are primarily driven by workers leaving their jobs or retirement, rather than growth.

Production agriculture faces several critical workforce issues.

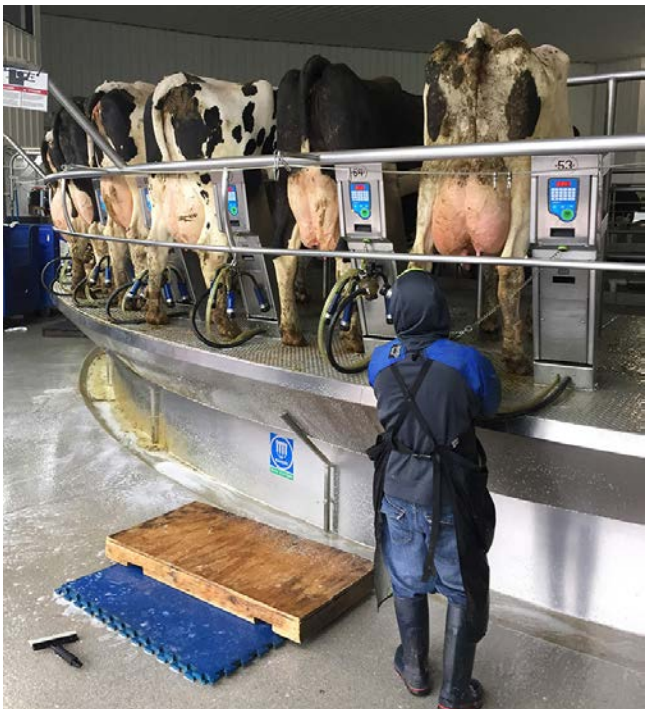
The workforce needs and challenges facing agricultural producers varies depending on the nature of the work. This section discusses the workforce issues and challenges as it relates farm laborers, equipment operators and truck drivers, and farm operators and farm managers.

Farm laborers

The survey responses indicated that one of the biggest challenge facing production agriculture is a general lack of farm laborers. This lack of available workers can impact some of the business decisions that farmers make. For instance, one farmer indicated that she had move away from more labor intensive crops such as fruits and vegetables because the difficulty in finding laborers did not afford them that level of diversification. It may also dictate the extent to which farm operators invest in labor-saving technologies to reduce their future demand for manual labor.

Workforce demands vary by the nature of farm operations, for instance:

- **Row crop operations** *(e.g., corn, soybeans)* have seasonal labor demands, but farmers still need reliable, experienced and highly motivated machinery operators. This need causes them to make full time, year-around job available for those key employees. Part-time high school, college or retirement age employees then support these full-time farm laborers as needed.
- **Livestock operations** *(e.g., swine and beef cattle)* typically demand reliable year-round, shift workers willing to work weekend shifts in rotation all year round. These operations have steady labor demands and rely upon on-the-job training to build productivity.
- **Dairy operations** large enough to employ significant labor tend to milk three times per day, requiring 24/7/365 staffing. These operations often attract immigrant laborers by providing housing, long work shifts and weekend work to enhance their income.
- **Horticultural operations** have labor demands as diverse as the industry. Full time, year-around employees form the backbone of the larger operations, but are supplemented by pools of seasonal employees. Seasonal employees may be local students, part-time employees or immigrant laborers.



Several factors contribute to limited number of laborers. Continued farm consolidation and rural population declines means that fewer people grow up with an exposure to production agriculture. Therefore fewer people are interested in agricultural jobs that are often outdoors, labor-intensive, dirty, relatively low-paying, and seasonal (in the case of fruit and vegetable growing). Moreover, agriculture often competes with employers in construction and manufacturing that often pay higher average wages and provide better benefits. For instance, the median hourly earnings of a general construction laborer in Missouri is about $20 per hour, whereas earnings farm laborers make $13 to $14 per hour.

Farmers can supplement their workforce by using migrant workers through the H2A Visa Program.[17] This program allows employers to bring foreign nationals to the US to fill temporary agricultural jobs. In Missouri, there were approximately 850 H-2A positions certified in 2016. These positions were largely intended to work in the construction of livestock buildings or in horticulture and produce (e.g., tomatoes, melons, apples, nurseries and greenhouses).[18] This program benefits farm operators with more seasonal workforce needs, but it is less applicable to dairies who have year round worker needs.

Equipment operators and truck drivers

A number of survey respondents and key informants noted a high demand for spray applicators, who have knowledge of agronomy, chemistry and experience operating equipment. In addition to this knowledge, applicators must also be accustomed to working relatively independently and willing to work long hours during peak times of the year. Farm operators often contract this work to larger agricultural services companies, like MFA Inc. or Nutrien Ag Solutions, although those firms experience similar difficulties filling these positions, particularly in more rural locations.

One agricultural services company indicated that they compete with "anyone with a truck" for truck drivers with a CDL.

To better meet these needs, MFA is partnering with The State Technical College of Missouri (State Tech) in Linn, Missouri
on a new program specifically designed to train custom applicators.[19] Program participants receive classroom training at State Tech to gain knowledge of mechanics and agronomy, and then receive practical experience working with MFA. As part of this program, MFA covers much of the costs (e.g., tuition), and in return students must commit to three years of employment with MFA.

Truck drivers represent another difficult to fill position, more so due to greater levels of demand than a lack of specialized skills. Not all farming-related trucking requires someone with a CDL, but reliable workers with this experience can prove difficult to find. Once again, this brings production agriculture into direct competition with employers in construction, manufacturing and distribution and logistics.[20]

Farm operators and managers

As farms consolidate and become bigger, farm operators and managers must continue developing basic business management, financial and accounting skills. Many farms are small businesses, so these business functions must often be performed in-house rather than out-sourced. Additionally, farming has an aging workforce with an estimated 40 percent of farmers and 30 percent of first-line supervisors of farm workers are aged 55 and older.[21] As a result, succession planning is one of the key business and workforce related issues to many farm operators and owners. A Missouri Farm Bureau survey reinforces these concerns noting that succession planning was the fourth biggest concern for farmers behind low commodity prices, input costs and access to capital.[22]

[17] *https://www.uscis.gov/working-united-states/temporary-workers/h-2a-temporary-agricultural-workers*
[18] *https://www.foreignlaborcert.doleta.gov/map/2016/MO.pdf*
[19] *https://www.statetechmo.edu/programs/industrialtech/gnt/*
[20] One agricultural recruiter that works throughout the Midwest noted that the explosive growth of shale gas development in North Dakota earlier this decade made it more difficult for agricultural employers to find truck drivers and equipment operators because the salaries were disparate between the two industries. As gas prices have fallen this is now less of an issue.
[21] Economic Modeling Specialists International, 2019 Q4. See Appendix C.
[22] *https://mofb.org/missouri-farm-bureau-survey-finds-farmers-hesitant-entering-2020/*

In order to remain sustainable and competitive, the next generation of farmers will need to make greater use of sensor-enabled automated data collection technology and artificial intelligence systems to improve decision making. Portals through tablet computers and apps on phones are also used to improve management. Several employers and stakeholders noted that the second- and third-generation farmers who grow up with technology, are more apt to use these innovations. These newer farmers are often being groomed to take over a family operation, and as a result are more likely to have a post-secondary education that better prepares them to use this information.

Other farm businesses contract some of this work to farm management and crop consultants. Workers in these fields often have subject matter expertise, but several employers noted that the most important skill these workers need is the ability to communicate. This was especially true for those people in forward-facing jobs, involving direct interaction with farmers and farm operators. Crop consultants must effectively convey the meaning and value of the information and why it will benefit the farming operation.

3.2 Agricultural support and services

Agricultural support and services is the most diverse segment of the food, agriculture, and forestry-related activities. Landscaping services (which, like production agriculture, has a substantial number of sole proprietors and non-employers[23]) accounts for 40 percent of the almost 33,000 wage and salary jobs within this industry segment. Veterinary services and farm equipment, machinery and supplies wholesalers each contribute approximately 7,500 wage and salary jobs. This segment also includes over 3,000 jobs in fertilizer and pesticide manufacturing.

Figure 9 shows the demand for several prominent occupations most associated with veterinary services—veterinarians, veterinary technicians, and veterinary assistants. These occupations are unique to food, agriculture and forestry, as these industries employ about 90 percent of the jobs within these occupations; the remainder are in industries such as colleges, universities and professional schools as well as state government. Although there are similar numbers of veterinarians and veterinary technicians, the projections indicate that these occupations will average 75 and 150 annual openings, respectively. The difference in need between veterinarians and veterinary technicians is due to turnover, as relatively low median earnings ($29,700 per year) and limited career opportunities cause a number of veterinary technicians to leave the occupation.

[23] Non-employers are businesses with no paid employees and receipts greater than $1,000 per year.

Farm equipment mechanics and service technicians are another prominent occupation with the agriculture support and services industry segment. There are currently about 1,100 farm equipment mechanics and service technicians; over the course of the next decade farm equipment and products wholesalers are expected to have over 100 annual openings for these positions. Although these technicians do not always require post-secondary education, many farm equipment mechanics and service technicians do require significant amounts of OJT (longer than 1 year) and specific equipment vendors (e.g., John Deere, Case IH, etc.) often provide additional training.

Figure 9: Common occupations in Missouri agricultural support and services

Occupation	Wage & Salary Jobs in Industry Segment (2019)	Total MO Wage & Salary Jobs	Proj. Avg. Annual Openings in Ind. Segment (19-29)	Median Annual Earnings
Jobs typically requiring post-secondary education or certification				
Veterinary technologists & techs.	1,479	1,605	146	$29,661
Veterinarians	1,467	1,599	76	$89,232
General & operations mgrs.	693	46,803	61	$81,494
Heavy & tractor-trailer truck drivers	614	45,123	69	$44,034
Bookkeeping, accounting, & auditing clerks	401	29,536	45	$36,774
Middle-skilled jobs				
Farm eqpt. mechanics & service techs.	1,109	1,402	106	$36,400
Sales reps., wholesale & MFG,except tech. & sci. products	980	25,444	104	$56,888
Chemical eqpt. operators	697	3,031	70	$41,558
Parts salespersons	336	6,118	43	$30,222
Unskilled & semi-skilled jobs				
Landscaping & groundskeeping workers	9,121	16,836	1,171	$29,016
Veterinary ass'ts. & laboratory animal caretakers	2,032	2,285	347	$26,957
First-line spvrs. of landscaping & groundskeeping workers	1,052	1,783	108	$44,346
Tree trimmers & pruners	952	1,153	118	$42,099
Secretaries & admin. ass'ts., except legal, medical, & executive	827	67,517	82	$33,738
Receptionists & information clerks	815	13,994	117	$26,770
Nonfarm animal caretakers	758	4,702	129	$21,466
General office clerks	627	42,530	75	$29,869
Hand laborers & freight, stock, & material movers	625	47,227	91	$28,891

Source: Economic Modeling Specialist, Int'l (2019.4)

The most common occupation within agricultural support and services industries is landscaping and grounds keeping workers. Within this set of industries over 9,100 people worked in this occupation (which involves mowing, planting, fertilizing, laying sod, etc.). Other common occupations related to landscaping include supervisors of landscaping workers and tree trimmers and pruners, which are occupations that typically require more skill and/or supervisory responsibilities. As a result the median earnings of these occupations are 40 to 50 percent higher than the average landscaping and grounds keeping worker ($29,000 per year).

Agricultural support and services employers encounter a variety of workforce challenges.

Given the wide range of activities within this particular industry segment, specific industries often face different and unique sets of workforce challenges. Below we highlight some of the key workforce challenges facing employers in veterinary services, agricultural equipment repair and landscaping services.

Veterinary services

A limited number of Missouri veterinary practices are purely large animal or food animal practices. Many practices—particularly outside of more dense urban areas—are mixed-animal practices which allows them to both serve local demand and generate a diverse set of revenue streams. The supply of veterinarians may meet the state's aggregate needs[24], but an uneven distribution of large or food animal veterinary services leaves many places underserved. For instance, some places may lack large animal veterinary services, but there are too few livestock operations to support a practice. More remote livestock operations are also challenge because the more time veterinarians spend driving to their clients operation ('windshield time'), the less time they have to see patients which can negatively impact the profitability and sustainability of their overall business. Larger veterinary practices have invested in haul-in clinics whereby the farm operator brings their animal to the veterinarian, rather than vice versa. These facilities allow veterinarians to see more animals, often in better working conditions (e.g., temperature) for both the vet and the animal.

There are both business and broader community considerations that affect a community's ability to attract veterinarians and support veterinary practices. Not only must there be a market to support a new practice, but there is also a need for broader community support from, for instance, the local banking community to provide financing and basic business mentorship. New veterinary practice owners and/or new associates also need mentors to help with the practical realities of practicing veterinary medicine as well as running a small business. These factors are necessary, but not always sufficient, to attract new veterinary practices or associates to work in rural communities. Veterinarians often have a range of options about where to live, so quality of life considerations like housing or schools quality, the ability for spouses to find employment, and other personal preferences come into consideration.

[24] The University of Missouri's College of Veterinary Medicine produced 110 Doctor of Veterinary Medicine degree graduates in 2018, and is the source of many—but not all— of the state's veterinarians. Over the next decade, the state projects to have over 80 openings for veterinarians annually (75 in the defined food, agriculture and forestry-related industries).

In order to encourage new veterinarians to work in places where the demand for food animal vets is insufficiently met, the Missouri Department of Agriculture established the Dr. Merrill Townley Large Animal Veterinary Student Loan Program in partnership with the University of Missouri's College of Veterinary Medicine.[25] This program provides veterinary medicine students up to $20,000 per year of loan forgiveness, in exchange for practicing veterinary medicine in a defined areas of need (e.g., veterinary population is diminishing, large animal populations/producers sufficient to potentially sustain/employ a large animal veterinarian, presence of livestock markets, etc.) for four years. The loan forgiveness program not only puts veterinarians in areas of need, but it also affords the new veterinarian greater freedom to start or buy into a practice.

The skills most needed by new and practicing veterinarians focus more on basic business skills than medical skills. At the most basic level, veterinary practices are small businesses. For these practices to survive and thrive, they must master day-to-day business skills such as managing their financials or properly pricing their services, and often face longer-term business considerations such as succession planning. While these subjects are covered through university training and continuing education, finding sufficient time for these subjects can be difficult given all the other demands of their time.

Both new and practicing veterinarians need to further develop their basic business skills.

Veterinarians cannot easily be replaced by a trained veterinary technician, but skilled veterinary technicians are nevertheless important for the practice of veterinary medicine.[26] There is projected to be almost 150 annual openings for veterinary technicians over the next decade; in 2018, 75 students completed associates' degree programs related to veterinary and animal health technology at Metropolitan Community College, Crowder College, Jefferson College, and the Midwest Institute. As result, there likely remains some unmet demand from both employers and students. Some of the unmet demand will be filled by Moberly Area Community College (MACC)'s new veterinary technology program. As part of this program, MACC will partner with the University of Missouri's College of Veterinary Medicine so that students can use the CVM's facilities.

As noted earlier, one of the big challenges facing veterinary technicians is the turnover caused by relatively low average earnings and a limited career path. It was observed that a career as a veterinary technician is a 6-year career because people begin the career making $30,000 per year, and six years later leave the profession because they are making the same. Approximately 53 percent of veterinary technicians are under the age of 35, which again reflects limited long-term career opportunities.

Unlike allied health professions (e.g. radiologist, occupational therapist) or nursing professions (e.g., certified nursing assistant, registered nurse, or nurse practitioner), the distinction between veterinary technicians and veterinary assistant is not always clear. This is one of the reasons why the new MACC veterinary technician program will allow completers to transfer into MU's veterinary nursing program.

[25] https://agriculture.mo.gov/connect/youth/vetstudent.php

[26] Through the veterinarian-client-patient relationship (VCPR), veterinarians assume the primary responsibility for an animal's health. Consequently, large animal veterinarians are not only the primary care givers to the state's livestock, but by bringing their trained eyes in the barns and fields, they are the first line of defense against the spread of animal diseases.

This program will send different signal about the nature and extent of the training that a graduate possesses. Providing greater clarity to employers about the value proposition of having better trained technicians can potentially raise the pay scale for well-trained veterinary technicians, but also provide them with better career paths and therefore reduce employee turnover in the profession.

Agriculture equipment repair

Farm equipment mechanics and service technicians are another area of unique pressing need, and given the level of specialized training required it is an area where farm equipment dealers must invest in worker training. For instance, Sydenstricker and Nobbe (S&N) Partners estimate that they currently need 36 equipment service technicians now, and 22 to 25 additional technicians per year in the future. To create this workforce, S&N Partners collaborates with State Tech's Power Sports Technology program on an agricultural equipment maintenance and repair apprenticeship. As part of this program, S&N Partners provides scholarships for students to attend relevant classes at State Tech, provides practical OJT and sends apprentices to John Deere training facilities in Illinois, Indiana and/or Kansas.

S&N Partners views this as both a strategy for filling their needs and retaining workers in key positions. Finding quality candidates for which to invest time and resources is one of their key challenges. Even though there are more people, recruiting for urban location can prove challenging due to the lack of an agricultural culture. By contrast, rural locations have fewer people to draw from, but the stronger farming culture means that more people understand the career options available by being a John Deere or Case IH technician. To address these recruitment challenge, S&N Partners plans to leverage their dealerships' involvement in the community to recruit good high school students. They are also learning from equipment dealers in other states. For instance, Oklahoma's FFA launched an agricultural mechanics contest and which some agricultural equipment dealers used as a recruiting opportunity.

Landscaping services

The landscaping services industry accounts for 12 percent of the total employment in all food, agriculture, and forestry-related industries. The jobs in this industry requires workers willing to do physically demanding, outdoors and seasonal work. Like many other food, agriculture and forestry-related industries, landscaping services are another industry that needs people capable of driving trucks (although not always requiring a CDL). Since they often work at multiple worksites, they need people with the leadership and communication skills necessary to provide first-line supervision.

While many workers do not require extensive training and education, several key positions do require skill and experience. In terms of more skilled occupations, there is a need for arborists and employers may prefer or prioritize people with degrees in arboriculture or forestry, or industry certifications (e.g., International Society of Arboriculture Arborist certification) to fill these positions. Skilled tree climbers are also viewed as a critical occupation, and these jobs often require significant OJT.

Landscaping services is also an industry comprised of many small businesses and large numbers of self-employed. In 2017, Missouri had almost 7,700 non-employers involved in landscaping services ventures. As a result, there is definitely a need for basic business skills to ensure the longer-term viability of these companies and enterprises. Among larger landscaping services companies, they must also have some business knowledge related to government or large institutional procurement in order to effectively compete for large contracts.

3.3 Food and beverage manufacturing

In 2019, food manufacturing was Missouri's second largest manufacturing sector (behind only transportation equipment manufacturing). It is also the largest (47,500 wage and salary jobs statewide) and fastest growing (1.7 percent annually between 2014 and 2019) segment of food, agriculture and forestry. Industries related to meat product manufacturing (e.g., poultry processing, animal slaughtering, etc.) contribute about 40 percent of the jobs in food and beverage manufacturing. Beverage manufacturing—which includes both large (e.g., InBev) and craft breweries, wineries, distilleries, and soft drink manufacturers account for 5,800 wage and salary jobs and dairy product manufacturing (e.g., milk, cheese, ice cream, etc.) employs another 5,600 wage and salary workers. Missouri is also one of the nation's largest states for pet and animal food manufacturing with roughly 5,000 jobs.

As with most manufacturing industries, Figure 10 shows that production occupations account for greatest share of jobs. Food batchmakers—which operate equipment that mix or blend ingredients used in manufacturing food and beverage products—are the largest, single occupation within food and beverage manufacturing (5,300 wage and salary jobs). This occupation is representative of many of these occupations, in that it typically does not require post-secondary education, pays $30,000 to $40,000 per year, and requires greater levels of OJT and experience.

Given the prominence of meat processing, occupations such as meat cutters and trimmers (4,100 jobs) and slaughters and meat packers (600 jobs) are common. These jobs are not for everyone as they often involve long hours of standing on your feet, colder conditions, and working closely with animals and meat. There is often a high level of employee turnover, although turnover varies within the industry.

Figure 10: Common occupations in Missouri food and beverage related manufacturing

Occupation	Wage & Salary Jobs in Industry Segment (2019)	Total MO Wage & Salary Jobs	Proj. Avg. Annual Openings in Ind. Segment (19-29)	Median Annual Earnings
Jobs typically requiring post-secondary degrees				
Heavy & tractor-trailer truck drivers	919	45,123	113	$44,034
General & operations mgrs.	569	46,803	54	$81,494
Industrial production mgrs.	324	3,422	28	$97,302
Bookkeeping, accounting, & auditing clerks	307	29,536	36	$36,774
Agricultural & food science techs.	247	636	29	$38,771
Middle-skilled jobs				
Food batchmakers	5,290	6,355	764	$33,176
Packaging & filling machine operators	4,757	10,506	604	$32,656
General maint. & repair workers	1,196	28,140	133	$36,150
Food cooking machine operators	1,132	1,353	164	$28,683
Inspectors, testers, sorters, samplers, & weighers	992	9,945	133	$39,416
Separating, clarifying, precipitating, & still machine operators	935	1,381	105	$41,267
Bakers	804	3,800	98	$24,107
Mixing & blending machine operators	719	2,563	102	$40,539
Industrial machinery mechanics	709	5,040	81	$52,582
Sales reps., wholesale & MFG,except tech. & sci. products	707	25,444	82	$56,888
Food & tobacco roasting, baking, & drying machine operators	641	836	79	$29,994
Butchers & meat cutters	479	3,337	67	$32,885
Unskilled & semi-skilled jobs				
Meat, poultry, & fish cutters & trimmers	4,103	4,623	553	$29,702
Hand laborers & freight, stock, & material movers	1,899	47,227	294	$28,891
First-line spvrs. of production & operating workers	1,562	13,324	177	$56,098
Industrial truck & tractor operators	1,311	12,479	163	$34,112
Hand packers & packagers	1,251	9,353	206	$24,606
Helpers--production workers	1,221	6,119	204	$29,266
Slaughterers & meat packers	612	693	97	$29,058
Cleaners of vehicles & eqpt.	593	7,936	90	$23,338
Shipping, receiving, & traffic clerks	574	11,486	65	$32,906

Source: Economic Modeling Specialist, Int'l (2019.4)

Food and beverage manufacturers also draw from the same workforce as other manufacturers, and the competition to fill several critical occupations was identified as being particularly challenging. For instance, food and beverage manufacturers employed almost 1,200 general maintenance and repair workers and 700 industrial machinery mechanics in 2019. These occupations—particularly industrial machinery mechanics—tend to be higher paying jobs not only because they require more skill, but because they are highly sought by other manufacturers.

Food and beverage manufacturers also employ significant numbers of packaging machine operators and first-line supervisors, as well as workers in managerial occupations such as general, operations or industrial production managers. As with every segment of Missouri's food, agriculture and forestry industries, food and beverage manufacturers also have a strong demand for truck drivers. In 2019, food and beverage manufacturers employed over 900 heavy and tractor-trailer truck drivers (which requires a CDL) and about 1,300 industrial truck and tractor operators.

Food and beverage manufacturing employers experience different challenges based upon their size and industry.

The critical workforce challenges facing food and beverage manufacturers varies depending on the nature of the business. Below we identify some of the specific challenges facing meat processors, other food manufacturers, and beverage manufacturers (e.g., wineries and breweries).

Meat processing

The most common workforce challenge facing many meat processors is finding sufficient numbers of reliable front line workers. Many meat processors emphasized their difficulty in finding workers with an adequate degree of work readiness, and who did not have problems with absenteeism or substance abuse. Furthermore, they want workers who have a willingness to work and stay in their job for any period of time—which was particularly challenging during the recent period of near full employment. As in other industries that rely heavily on relatively low wage workers, the cost of employee turnover can be significant.

There are a number of ways in which employers attempt to address this challenge. Tracking the labor market and offering competitive wages can help reduce turnover. One large meat processor noted that improvements in safety led to a decrease in turnover. Others have helped to organize ride-sharing programs, and one large meat processor even explored setting up their own daycare facility.[27]

[27] Childcare can be a retention concern particularly for larger employers operating multiple shifts. The large food processor that explored to possibility of establishing its own daycare facility opted not to go forward because they could not meet the state mandated ratios of childcare workers to children during the periods around a shift change.

Smaller meat processors such as a local custom-exempt plants or butcher shops often have similar difficulties in finding workers, particularly as part of their slaughtering operations. One small meat processor viewed their meat cutting positions as more of a craft, akin to butchering, and as a result different than what might occur at large meat processors where machines do more of the work. This emphasis on the craft part of the jobs was part of the message used to try and attract new workers. In addition to learning the basics of food safety, production and animal handling, it can take 6 months to a year to become proficient in animal slaughter. This is especially true for smaller meat producers who butcher a variety of animals such as cattle, swine, deer, goats, and/or sheep. Given the investment of time preparing people to work these jobs, turnover remains a big challenge for both large and small meat processors.

Smaller meat processors often have difficulties in finding reliable workers, particularly as part of their slaughtering operations.

Many meat processors, particularly larger firms under state or federal inspection, have made investments in technology and automation to reduce their demand for lower skilled labor. This has also led to an increased demand for skilled workers such as maintenance mechanics. Automation is less an option for smaller meat processors because they often lack the financial resources to invest in automation technology. Moreover, the diversity of activities in terms of animals processed (e.g., cattle, swine, goats, etc.) and products produced (e.g., steaks, sausage, bacon, jerky, etc.) does not lend itself to an affordable automated solution. Recognizing that it was unrealistic to fully automate their processes, one small meat processor did note that they were looking to make investments in their packaging activities.

Beyond more production-oriented jobs, larger firms also need workers with more technical backgrounds in microbiology or meat science. Several employers noted they hired workers for these technical positions from Northwest Missouri State or the University of Missouri, but they also looked out of state to institutions like Iowa State University or University of Nebraska to meet their needs. One firm noted that the protein industry can be a relatively small world, so it was good to bring people in from all over the country to ensure diversity of thought.

Other food processing

Much like the state's meat processors, and manufacturers more generally, other food manufacturers need workers with basic work skills. In a tight labor market, it is not only challenging to find reliable front-line workers, but it is also difficult to find workers for more skilled positions. As noted above, finding electrical and maintenance workers is a challenge for food manufacturers and manufacturers more generally.

Depending on the nature of the business, some workers may require much more extensive and specialized training. For instance, one dairy products manufacturer noted that that their boiler operators must have three years of hands-on experience, or an

ammonia certification from a 4-month program at a technical school in Garden City, Kansas. Similarly, their cheese department required one employee per shift who is trained in low acid foods. Consequently, these workers participate in an online training program through the University of Wisconsin. These types of positions are often relatively small in number, but are nevertheless critical to this firm's operations. As a result, these employers must be able to find workers to invest time and resources into training and focus on retaining these workers moving forward.

Food manufacturers also note that the lack of work flexibility was another retention challenge. Unlike durable goods manufacturers, many food manufacturers produce perishable products with a relatively short shelf-life. This often leads to a lot of night and weekend work. Even if they offer competitive pay, their work schedule puts them at a disadvantage with other employers that offer more attractive hours and work days.

Beverage manufacturing

Beverage manufacturers face some of the same challenges facing food manufacturers, such as finding and retaining lower and semi-skilled workers. However, Missouri's wineries, breweries and distilleries also experience some difficulty in finding the technical talent they need to succeed and thrive in competitive industries. Without a dedicated fermentation sciences program, many of the state's wineries rely upon the Viticulture and Enology Science and Technology Alliance (VESTA) program to provide technical training for winemakers. The VESTA program was established in 2003 through a grant from the National Science Foundation. VESTA students have access to over 30 industry-validated online courses in viticulture, enology and wine business entrepreneurship, and receive practical training through mentored field experiences. Through this program, participants can receive an associate's degree and/or technical certificates through a host institution—in Missouri, Missouri State University and Missouri State University-West Plains.

Some Missouri wineries are also exploring greater use of registered apprenticeships to strengthen their workforce. There are currently five wine-related registered apprenticeships in Missouri related to cellar workers, assistant wine makers and vineyard workers, and another is being considered for tasting room associates. The latter is a particularly important because tasting room associates are the main point of contact that many customers have with the winery, and for many wineries much of those sales occurs on premises.

Though talent and workforce remains a top five issue, the most pressing issues facing breweries, wineries and distilleries revolve around regulatory or permitting issues. The number of wineries in Missouri has held relatively steady

(around 130) over the past half-decade, and the VESTA program has helped the state's wineries meet its technical workforce. In order to support breweries, particularly in the St. Louis region, Saint Louis University's School for Professional Studies recently created a Certificate program in Brewing Science and Operations**.** Developing this talent is important for beverage manufacturers to keep up with the rapidly changing preferences of their customers. They must continually innovate and deliver quality products in a competitive landscape where quality is more important than local in the consumer's mind.

3.4 Forestry and wood products manufacturing

In 2019, there were approximately 16,500 wage and salary jobs within forestry and wood product manufacturing-related industries, or over 13 percent of all food, agriculture and forestry-related jobs. This employment has been relatively steady since the last recession, although it is down significantly since 2001 when employment was closer to 22,000. Converted paper product manufacturing (e.g., boxes, stationary) accounts for almost half of these jobs. Industries such as wood container and pallet manufacturing (2,600 wage and salary jobs) and sawmills (2,000 wage and salary jobs) also generate significant employment, and these two industries contributed almost 600 net new jobs between 2014 and 2019.

Figure 11: Common occupations within Missouri forestry and wood products manufacturing

Occupation	Wage & Salary Jobs in Industry Segment (2019)	Total MO Wage & Salary Jobs	Proj. Avg. Annual Openings in Ind. Segment (19-29)	Median Annual Earnings
Jobs typically requiring post-secondary education or certification				
Heavy & tractor-trailer truck drivers	250	45,123	28	$44,034
General & operations mgrs.	230	46,803	20	$81,494
Industrial production mgrs.	113	3,422	9	$97,302
Middle-skilled jobs				
Paper Goods machine operators	2,728	3,409	269	$43,410
Wood Sawing machine operators	1,488	2,083	170	$24,856
Woodworking machine operators, except sawing	1,247	1,929	148	$27,893
All other assemblers & fabricators, incl. team assemblers	794	24,982	88	$36,504
Printing press operators	287	4,712	31	$41,413
Cabinetmakers & bench carpenters	270	2,334	30	$33,342
Sales reps., wholesale & MFG,except tech. & sci. products	269	25,444	30	$56,888
General maint. & repair workers	262	28,140	28	$36,150
Packaging & filling machine operators	245	10,506	29	$32,656
Cutting & slicing machine operators	219	1,411	26	$37,731
Unskilled & semi-skilled jobs				
Hand laborers & freight, stock, & material movers	581	47,227	84	$28,891
Industrial truck & tractor operators	535	12,479	62	$34,112
First-line spvrs. of production & operating workers	479	13,324	51	$56,098
Helpers--production workers	395	6,119	63	$29,266
Machine feeders & offbearers	277	1,763	39	$27,310

Source: Economic Modeling Specialist, Int'l (2019.4)

Given the prominence of manufacturing-related activities, production occupations represent the majority (65 percent) of the jobs in the forestry and wood products. Figure 11 shows common occupations within forestry and wood products-related industries, and many of these are unique to these industries. Approximately two-thirds of forestry and wood products manufacturing jobs do not require any post-secondary education, but they do require moderate and/or long-term OJT. Given the prominence of paper products manufacturing (e.g., box, paperboard, or sanitary paper manufacturing), a large number of paper goods machine operators (2,700 wage and salary jobs) work within this set of industries.

Other common occupations with over 1,000 jobs each include wood sawing machine operators (e.g., sawyers) and woodworking machine operators. They both have median earnings well below paper goods machine operators. Most of the openings within these occupations are the result of employee turnover rather than growth. As with other manufacturers, employers in these industries need general maintenance and repair workers and sales representatives. These industries also have a number of occupations that require short-term or no OJT, such as hand laborers and freight movers, and truck and track operators. With the exception of first-line supervisors, these occupations tend to have relatively low average earnings.

Relatively fewer positions typically require any kind of degree or postsecondary certification, although like food and agriculture employers, forestry and wood products manufacturers employ many heavy and tractor-trailer drivers (which typically requires a CDL). Managers are the other occupation that typically require some kind of post-secondary education or certification. These occupations, particularly managerial occupations, tend to pay relatively higher average earnings.

Forestry and wood products manufacturing employers must find future, trainable workers.

As with other manufacturing industries, forestry and wood products employers industries identified challenges filling a mix of lower skilled (e.g., general labor) and skilled (e.g., sawyers, CDL drivers) positions. The employers interviewed mentioned that positions requiring specific technical knowledge or subject matter expertise—timber buyers, lumber inspectors, and maintenance technicians—as critical jobs that were sometimes difficult to fill. However, finding sufficient numbers of workers to fill lower skilled positions was especially difficult; one wood products employer noted that manual labor is a limited resource throughout the state, but particularly in rural areas.

Since most forestry and wood products related jobs do not require any post-secondary education, these industries often take a 'grow your own' approach toward filling more technically skilled positions (e.g., sawyers). To fill these positions, employers need workers with basic level of work readiness and the ability to learn more advanced skills which makes worker retention an important issue. However, any forestry and wood products employers find themselves in direct competition for workers with other industries. For instance, several employers that were driving distance to larger metro areas noted that they lost workers to the construction industry, which needs workers with overlapping skill sets and often pays higher wages.

Forestry and wood products industries often take a 'grow your own' approach toward filling more technically skilled positions (e.g., sawyers).

To continue meeting these needs in the future, the forestry and wood products industry needs a stronger pipeline of workers moving into the industry. Consequently, the demand is for non-college bound students or adults wanting to learn a new trade. Although these workers do not necessarily need postsecondary education, they do need to learn how to properly use a chainsaw and other equipment, as well as some basic forest management principles.[28] In order to address some of these needs, the Missouri Forest Products Association has launched a Logging School which helps workers earn their Professional Timber Harvester (PTH) certification.[29] This program, however, needs more student interest. One of the particular program challenges is that since it is a 10 week course and not associated with other post-secondary programs, so students do not qualify for financial aid.

The forestry and wood products industry also has a steady need for foresters, although this is a less pressing need than finding reliable skilled and lower skilled laborers. Within the state of Missouri, Three Rivers College has a two-year associate's degree that allows graduates to transfer to the University of Missouri. MU has the state's only accredited forestry program (B.S. Natural Resource Science and Management with emphasis in Forest Resources), and graduates about 15-20 people per year. These numbers are consistent with the national average of similar programs and graduates go on to work in the private sector or state government. The latter provides graduates with the opportunity to gain good experience, but sometimes struggles to fill its forester positions because its wages are not as competitive as private sector wages.

Beyond this technical knowledge, there is a need within to the forestry and wood products industry to further enhance basic business knowledge. For instance, many logging businesses are family-owned businesses and as the principals in those businesses age, there is a real need for assistance with succession planning. Basic business counseling can also help Missouri's roughly 1,550 forestry and logging non-employers not only survive, but also get to a point where they might be able to add employees.

[28] These principles are important because the sustainability of timber resources is critical for the industry's longer-term viability. Without this basic forest management knowledge, loggers may practice 'high-grading' whereby they take the best trees and leave the worst to repopulate the next generation of forest.
[29] *https://www.moforest.org/logging-school/index.php*

4. COMMON WORKFORCE ISSUES FACING MISSOURI'S FOOD, AGRICULTURAL AND FORESTRY EMPLOYERS

The previous section discussed many of the workforce issues and challenges facing specific industries or related to individual occupations, but many of these employers share common workforce challenges. These challenges—primarily identified through the survey and key informant interviews—often speak directly to the need to strengthen the pipeline of talent within food, agriculture and forestry-related industries. There is no one solution to this challenge, however, and employers must attract new and existing workers into their industries, in addition to training and preparing them to do the work. Moreover, the nature of work is changing, and some employers are better able to adapt than others. The extent to which employers, government, and educators address these challenges will determine how well food, agriculture and forestry employers meet their workforce needs over the next decade.

4.1 Missouri must encourage new workers to consider careers in food, agriculture and forestry

Exposing young workers to consider careers in food, agriculture and forestry is an important first step in constructing a talent pipeline. This is particularly important for the jobs unique to these industries, as employers must prepare a steady supply of younger workers to replace an aging workforce. Younger workers also bring different perspectives and capabilities that keep firms competitive, and having grown up with technology are often more quick to adopt and use new technologies that save labor and enhance productivity.

Attracting more young workers into food, agriculture and forestry-related careers means generating more interest and enthusiasm in food and agriculture-related careers. It also requires correcting misperceptions about these careers, as not all of these jobs are low-wage, low-skilled, and physically demanding. This may be true for some jobs, but production agriculture and food processing are continuously becoming more technical and the public does not often see the high degree of technology involved in these industries.[30]

Youth groups like 4-H and FFA provide basic skills and knowledge, but they often instill basic characteristics related to personal responsibility and leadership that many employers seek.

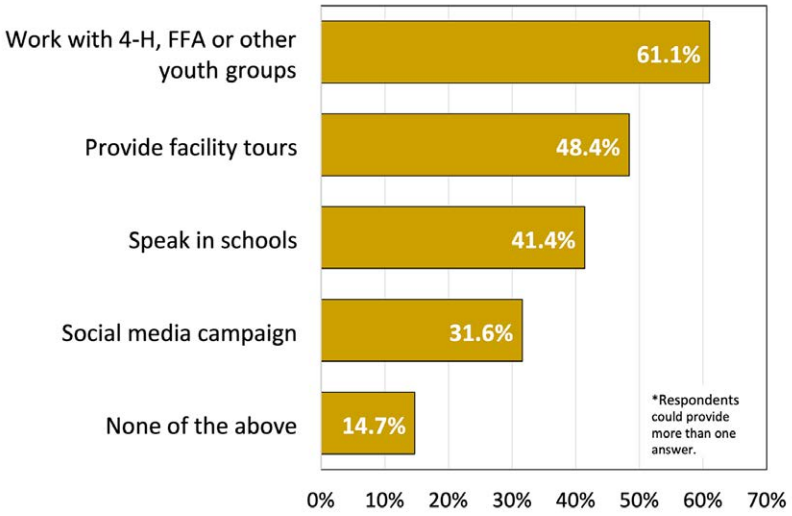
Throughout this research a diverse array of employers and stakeholders emphasized the need for the public, and especially younger people, to better understand agriculture and food systems more broadly. Farm operators and food manufacturers felt that a stronger knowledge of food systems was critical for interesting new workers in careers in food and agriculture. This view was also held by venture capitalists and agricultural technology firms, not only for career exploration purposes, but also to help people identify future business or entrepreneurial opportunities. More generally, greater knowledge of food systems allows us to simply be more knowledgeable consumers and more informed about the food we put in our bodies.

[30] Food and Agriculture Workforce Capacity-Building in Michigan: A Critical Examination. Prepared by the International Food Protection Training Institute, June 2015.

Youth groups are important partners for promoting careers in food, agriculture and forestry.

Employers use several methods to promote food, agriculture and forestry-related careers. Figure 12 shows that over 60 percent of survey respondents indicated that that they worked with youth groups like 4-H and FFA to promote food, agriculture and forestry-related careers. Through a variety of activities and programs, these groups expose youth to agriculture in a way that raises awareness of—and generates enthusiasm for—careers in food and agriculture and beyond. Several employers specifically sought to recruit members from local FFA chapters. Not only did these youth groups prepare their members with basic skills and knowledge, but they often instill basic characteristics related to personal responsibility and leadership that many employers seek. In addition to generating interest in agricultural careers, these programs can also help generate interest in post-secondary programs related to agriculture.[31]

Figure 12: Efforts to promote food, agriculture, and/or forestry careers to youth



Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

Groups like FFA and 4-H, as well as local schools, also help to organize facility tours. Almost half of the survey respondents indicated that they provided facility tours to youth groups. These tours showcase the work environment for students and help them understand some of the basic tasks and duties involved with this work. Furthermore, demonstrating advanced machinery and equipment can pique student curiosity about working in manufacturing or agriculture. Several employers noted that these tours never directly led to a future employee, but they nevertheless viewed facility tours as an important way to promote careers in agriculture or manufacturing more broadly. More intensive exposure for students can be gained through job-shadowing opportunities that allow students to witness the activities and tasks associated with a given job. They also provide a venue for the hosts to talk about their job and gauge student interests in similar careers.[32]

[31] Although these groups were identified as important sources of future workers, they only reach a fraction of Missouri's high school students. According to the Missouri Department of Elementary and Secondary Education there were 25,920 FFA members in Missouri in 2015-2016; there were approximately 240,000 Missouri high school students the same year.

[32] For more information about job shadowing in agricultural and logistics of effectively organizing these activities, see Nodine, T., 2016. Job Shadowing in Agriculture: How Ag Prep is Connecting School with Work**.** Prepared by Jobs for the Future.

Over 40 percent of survey respondents also spoke in schools to promote career opportunities. These engagements often take place in high schools, but given that career and technical education (CTE) best prepares students for many of these jobs employers should also seek to engage middle school students who have yet to select their educational path. There is a need not only to engage students, but also teachers to CTE more broadly. A recent statewide survey about perceptions of CTE in Missouri found that almost 90 percent of educators agree that CTE exposure should begin before high school, but many K-8 teachers lack basic knowledge about CTE.[33]

Agricultural education is critical for creating future workers.

Teachers are important actors in promoting careers in food, agriculture and forestry. Through the state's agricultural education programs, students gain exposure to topics related to plant science, livestock, mechanics, food sciences, forestry and agribusiness. Teacher externships expose teachers to the practical needs of businesses, and with that information and experience can make their curriculum more directly relevant to employers' needs. These externships are ongoing throughout Missouri, but they often occur in a relatively ad hoc manner based on the relationships between individual employers and school administrators, counselors and teachers.

Although agricultural education can lead students toward agricultural careers, not all schools have agricultural education programs. Those that do tend to be in more rural communities, as the most urban districts with agricultural education programs are Blue Springs and Columbia. Given that most of the state's population lives in urban and suburban areas, many students are not exposed to agriculture and lack access to agricultural education programs. Where these students might have some exposure to animal health or plant sciences, it is viewed through the lens of broader STEM education (Science, Technology, Engineering and Mathematics) as opposed to practical understanding of food, forestry and agriculture.

Many of the same skills that make agricultural education or CTE teachers effective as teachers—the ability to use tools, knowledge of safety procedures, ability to supervise and communicate—are also in-demand skills within the private sector.

Teacher retention is another challenge facing agricultural education, and these challenges result from a combination of older agriculture teachers retiring and younger teachers choosing different careers. Many of the same skills that make agricultural education or CTE teachers effective as teachers—the ability to use tools, knowledge of safety procedures, ability to supervise and communicate—are also in-demand skills within the private sector. As a result, retaining teachers through their first five years has proven difficult as school districts cannot compete with private sector wages. This is a significant challenge given the important role that teachers play in encouraging students to consider these careers and preparing them with the basic skills needed to enter these careers.[34]

[33] Russell, R. and White, M. 2020. Perceptions of Career and Technical Education in Missouri. Prepared for Missouri Department of Elementary and Secondary Education's (DESE) CTE Advisory Council.

[34] Over the past decade, Missouri post-secondary institutions have graduated approximately 60 students per year with degrees in agricultural education, with approximately two-thirds as bachelor's degrees, and one third are graduate degrees. Over the next decade Missouri is projected to have approximately 45 annual openings for career and technical education teachers (which includes agricultural education).

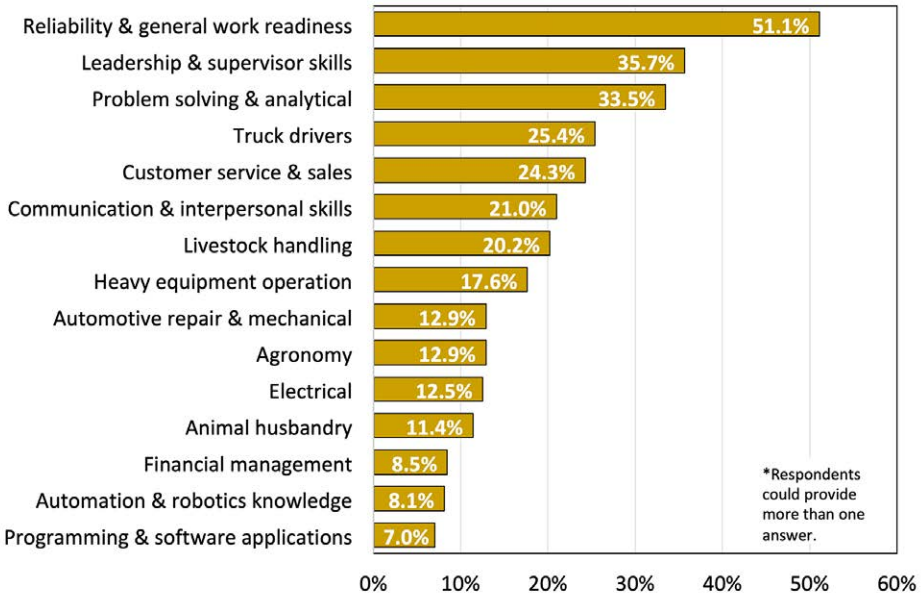
4.2 Food, agriculture and forestry employers compete for both skilled and less-skilled workers

Finding reliable, front-line workers is a consistent challenge expressed by food, agriculture and forestry employers. This is especially true for those jobs that involve manual labor or work with long/inconsistent hours. Many employers—through both the survey and the key informant interviews—indicated that finding workers with basic work skills who will reliably show up on time, pass a drug screening, and/or stay in a job for any period of time was their single most pressing workforce challenge more so than finding workers with specific knowledge or subject matter expertise. Figure 13 shows that the three most difficult to find skills from the survey were reliability and general work readiness (51 percent), leadership and supervisory skills (36 percent), and problem solving and analytical skills (34 percent). Another 21 percent of employers indicated that it was also difficult to find workers with communication and interpersonal skills.

Many employers indicated that finding workers with basic work skills who will reliably show up on time, pass a drug screening, and/or stay in a job for any period of time was their single most pressing workforce challenge.

The survey evidence shows that these challenges are more acute in food, agriculture and forestry than in the Missouri workforce overall. In 2019, the Missouri Economic Research and Information Center (MERIC) conducted a statewide employer survey that showed 47 percent of employers statewide experienced the same challenge.[35] The University of Missouri survey—which ran during a period with similar economic conditions—asked the same question to the state's food, agriculture and forestry

Figure 13: Most difficult skills to find when hiring



Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

[35] The 2019 Missouri Economic and Workforce Report included findings from a statewide employer survey. This survey was done in partnership with St. Louis Community College's Workforce Solutions Group. The survey, which was conducted by phone by a professional survey firm, was the result of 1,657 Missouri employers.

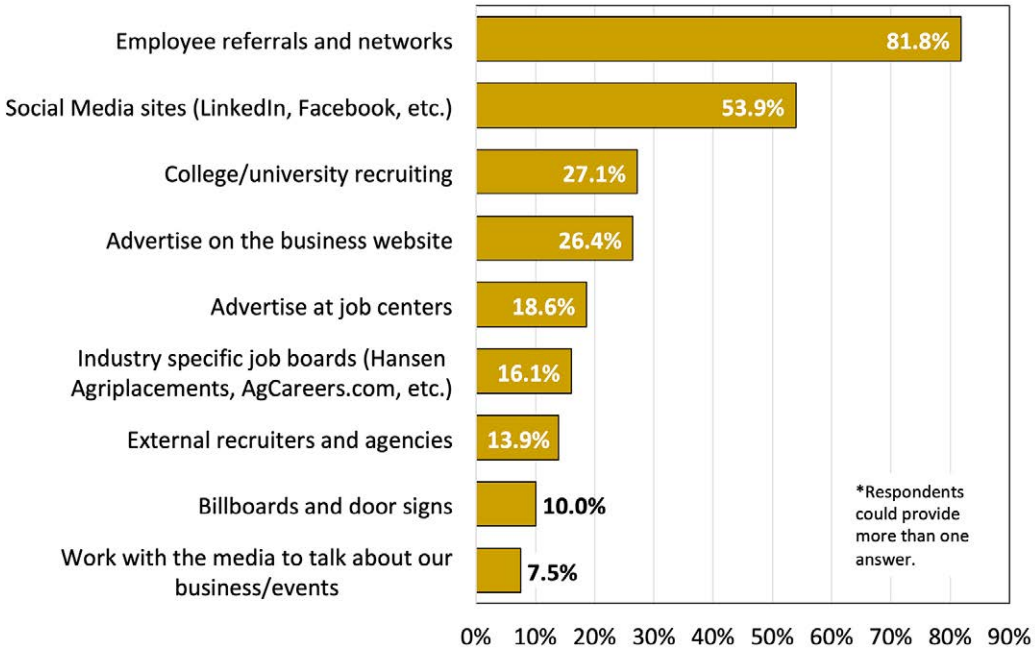
employers. It found that over 70 percent of survey respondents identified a shortage of workers with knowledge and skills as their biggest barrier to expanding employment. The difference in the survey results highlight the difficulty that food, agriculture and forestry employers face, relative to Missouri employers more generally, because of their heavy reliance on relatively low-wage, manual laborers. The extent to which the COVID-19 economic downturn affects this issue remains to be seen, but these challenges will likely re-emerge once the economy recovers.

Food, agriculture and forestry employers use employee referrals more than any other recruitment practice.

Figure 14 shows that the most common recruiting practices among survey respondents was leveraging existing employee referrals and networks. Over 80 percent of the respondents indicated using referrals to fill current positions. Employers noted that referrals sometimes served as a screening process because bad referrals reflects poorly on the referring employee. Several employers also referenced programs that reward workers who made referrals for other workers who were eventually hired and, for instance, stayed for at least six months.

Over half of the survey respondents advertised available positions online, by using social media sites like LinkedIn or Facebook, and a quarter of respondents advertised their positions on their business website. A smaller proportion of firms advertised at job centers, on industry specific job boards, or used external recruiters or placement agencies. These recruitment practices were primarily used by firms with over 50 employees that typically have dedicated human resource staff and resources.

Figure 14: Recruitment practices to fill current jobs



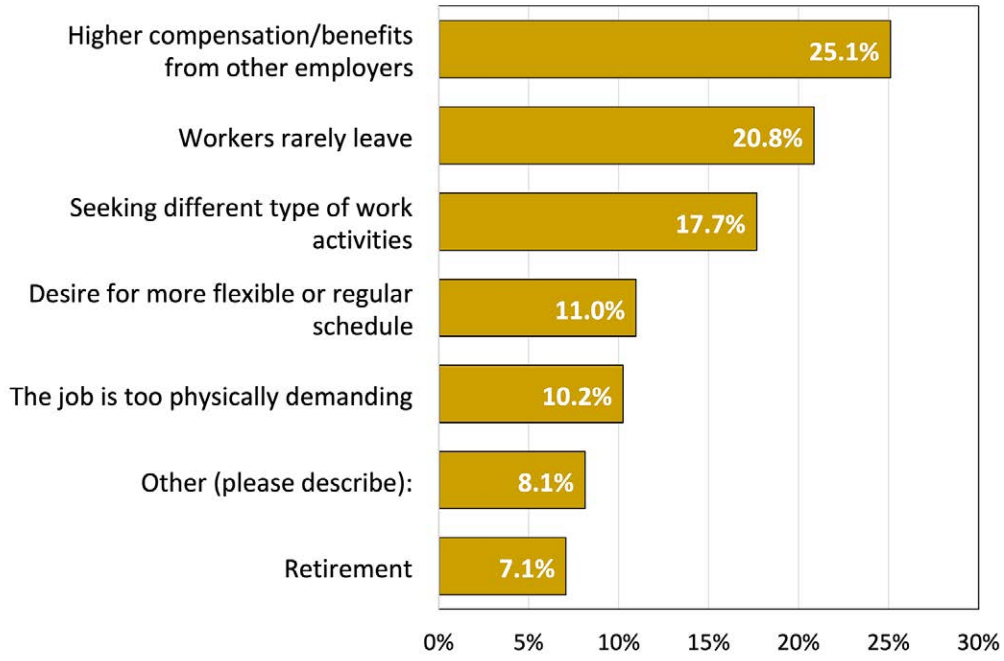
Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

Worker recruitment and retention can prove challenging as other industries seek similar workers.

Figure 15 identifies the most common reasons why Missouri workers leave their business. One out of every four respondents noted that higher compensation or better benefits from other employers was the primary reason. This is understandable given that food, agriculture and forestry employers not only compete with industries such as manufacturing, construction and distributions and logistics for workers to fill specific occupations (e.g., heavy and tractor-trailer truck drivers, industrial maintenance mechanics), but they also compete with employers looking for similar types of workers (e.g., manual labor). However, wages are only part of these earnings calculations. One large food manufacturer in St. Joseph noted that they lost a number of workers when Amazon opened up a new distribution center in Kansas City, Kansas. Even though the wages were somewhat lower, workers lowered their transportation expenses and reduced their commuting times.

Almost 18 percent of survey respondents indicated that the main reasons workers left jobs was to find a different type of work. Only 11 percent of respondents noted the desire for more flexible or regular schedules was the most common reason workers left positions, but this was an issue that arose in several key informant interviews. In some instances, long and irregular hours are unavoidable. In production agriculture long hours are required during planting or harvest season, while in food manufacturing multiple shifts and weekend work are often needed to optimize plant efficiency or meet market demand.

Figure 15: Most common reason workers leave their jobs



Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

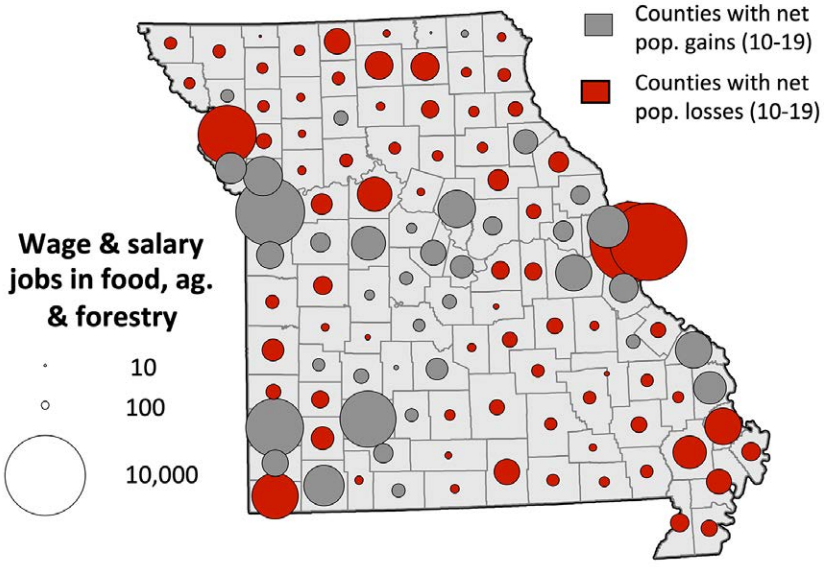
Some firms changed their work schedule in an effort to retain their workforce and reduce turnover. For instance, one lumber yard noted that workers preferred to start earlier in the day. As a result, they shifted their work schedule to four 9-hour days starting at 6 am and then a half day on Friday. Even though they paid relatively lower wages, their workers appreciated having more available time in their afternoons and a longer weekend. Not all firms have this flexibility, so employers look to other methods such as ensuring competitive wages, improving safety, or organizing ride-sharing programs to better retain their workforce.

Demographic trends make finding workers more challenging, particularly in rural Missouri.

One reason why employers find it increasingly difficult to find workers is because declining populations—particularly in Missouri's rural counties—limit the total number of workers from which employers can draw. Figure 16 shows that approximately 53 percent of the state's food, agriculture and forestry jobs were located in the 76 Missouri counties that experienced net population losses between 2010 and 2019; 36 percent of these jobs are in the 48 counties that have fewer residents today than they did in 2000.

Over 19,000 food, agriculture and forestry jobs are in St. Louis City and St. Louis County—both of which experienced net population losses this century—but those population losses have been partially offset by growth in suburban counties like St. Charles. That said, population decline and out-migration is a chronic condition for smaller communities in traditional agricultural areas such as Northwest and Southeast Missouri. These demographic trends have real implications for these communities' food, agriculture and forestry workforce, and their workforce more generally. It becomes hard to find laborers, because there are simply fewer laborers available.

Figure 16: Wage and salary jobs in food, agriculture and forestry in counties with population gain and loss since 2010.



Source: Economic Modeling Specialists, Int'l (2019.4), US Census Bureau Population Estimates, v2019

In more rural locations, several factors limit the pool of workers from which employers can draw. For instance, many workers in relatively lower paying jobs lack reliable personal transportation or do not have public transportation options. This can also be a challenge in larger metro areas that may have more potential workers to draw from but commuting time and a lack of a coordinated public transportation system are a barrier. Rural locations also tend to have limited childcare and a relative lack of multifamily housing and rental options, so workers cannot find adequate and/or affordable housing.

Many food, agriculture and forestry employers draw their labor force from the local labor pool, but rural employers also experience difficulty attracting more mobile workers with marketable and transferable skills. Particularly during good economic times, these workers can often select where they want to live and work. Rural communities that lack quality of life amenities—quality housing and schools, high speed internet, retail businesses or healthcare services—find themselves at a disadvantage. Moreover, a relatively low density of similar jobs can make it difficult for workers' spouses to find work, or for them to find a different job if necessary.

Several food, agriculture and forestry employers expressed difficulty in finding white collar workers to fill both technical positions and more general business operations positions like finance and accounting. For instance, several employers in rural mid-Missouri mentioned that some of their white collar workers may drive 45 minutes or more from Columbia. Similarly, St. Joseph pulls a number of workers from Platte and Clay counties. In these situations, employers can face retention challenges because these workers might be able to find jobs with shorter commutes.

When the labor market is tight, employers must expand their search.

A number of employers have looked to non-local sources for additional labor. For instance, almost 30 percent of the survey respondents indicated that they would hire or consider hiring H-2A guest workers. As noted earlier, there were approximately 850 H-2A positions certified in Missouri in 2016. The H-2A is not a simple solution for farm employers. It involves significant regulatory and administrative barriers (e.g., provision of housing and transportation, transportation to and from the home country, state inspections of employee housing, among others) that discourage many employers from using the program. In spite of these administrative requirements, many employers say that the reliability of the H-2A workforce is worth the additional effort and cost.[36]

Beyond agriculture, food processors also use foreign-born workers to help meet their labor needs. In two key occupations—slaughters and meat packers, and meat and poultry cutters and trimmers—less than half of the workers in Missouri are White, non-Hispanic.[37] Employers draw from more than just the Mexican and Central American population. For instance, it was noted that Smithfield's Milan plant employs workers from the Kirksville's Congolese refugee population. Similarly, Triumph Foods in St. Joseph has found reliable workers in Wyandotte County's Burmese refugee population. Through their churches, some of these workers organize shuttle vans to take them to work in St. Joseph, reducing their transportation costs. Other meat processors have

[36] The State of the Agricultural Workforce in New York. Prepared by Cornell College of Agriculture and Life Sciences and Charles H. Dyson School of Applied Economics and Management at Cornell University, March 2019.
[37] ***Economic Modeling Specialists International, 2019 (Q4).***

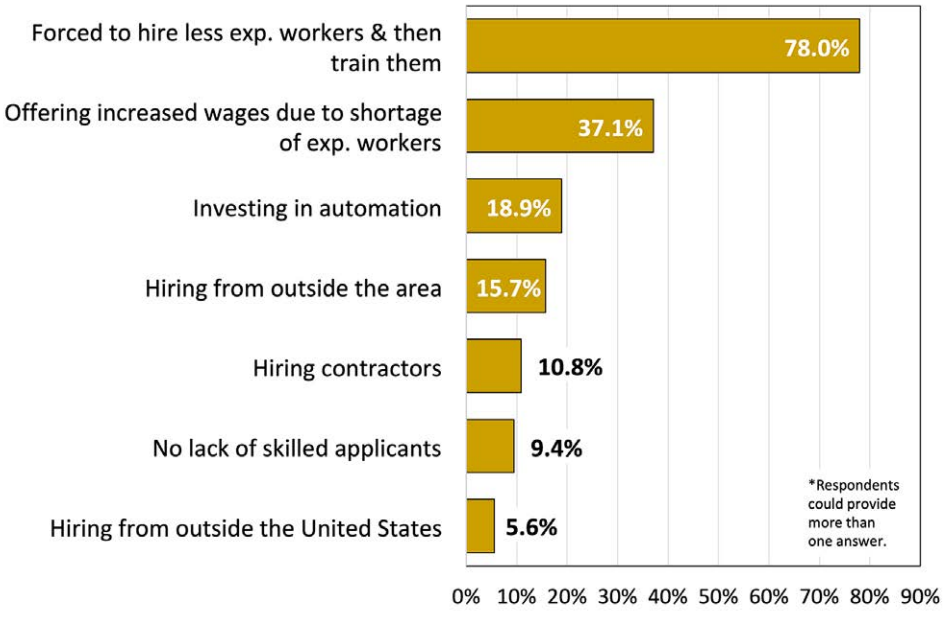
hired Puerto Rican workers, much in the same way as the hospitality industry in Branson. Since they are American citizens, Puerto Rican workers do not present legal and administrative challenges that come with some immigrant workers.

Employers also look at underutilized sources of labor. During tight labor markets, justice involved workers (e.g. ex-offenders) are one source. Almost 45 percent of survey respondents indicated that they would consider hiring ex-offenders to meet their workforce needs. Amanzi Farms, a Sikeston-based hydroponic lettuce farm, has utilized incarcerated workers as a way of finding a more reliable, minimum wage workforce.[38] Amanzi Farms' incarcerated workforce participate in a Registered Horticultural Crop Specialist Apprenticeship program, where they are trained in OSHA and food safety. Once employed at Amanzi Farms, they are paid minimum wage and able to develop work skills that prepares them for life after their prison release. In Maryville, Lettuce Dream is a hydroponic lettuce farm that works with people with developmental disabilities and prepares them with basic work skills. Some of their graduates have, for instance, gone on to work in home and garden stores.[39]

4.3 Maintaining a competitive workforce requires continued training and education

The employer survey was conducted during a period of low unemployment and a relatively tight labor market. As a result, Missouri's food, agriculture and forestry employers identified the lack of both skilled and lower skilled workers as their biggest workforce challenge. Figure 17 shows that 78 percent of employers responded to the shortage of skilled labor by hiring less experienced workers and providing subsequent training. This figure was consistent with MERIC's 2019 statewide employer survey.

Figure 17: Employer efforts to adapt to a lack of skilled job applicants



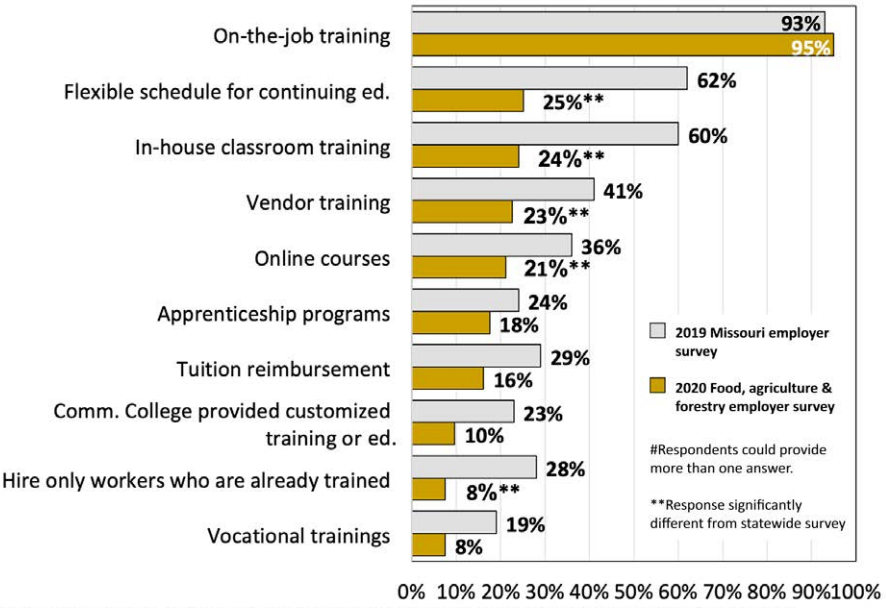
Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

[38] https://www.semissourian.com/story/2578987.html
[39] http://www.lettucedream.org/

Another 37 percent of employers increased wages due to the shortage of experienced workers; a figure somewhat lower than the statewide response of 49 percent. Food, agriculture and forestry employers were also less likely to hire contractors or hire from outside the region, as workers do not often move for relatively lower wage jobs. As a result, food, agriculture and forestry jobs must rely on their local labor markets to fill many of their positions but given this relative lack of turnkey workers, employers must invest in training to grow and maintain a competitive workforce. This section discusses some of the training issues facing employers across food, agriculture and forestry-related industries.

Food, agriculture and forestry employers use OJT more than any other training method.

Figure 18: Methods used to train incumbent workers to a lack of skilled job applicants



Source: MU Extension Food, Agriculture & Forestry Employer Survey, Jan.-March 2020; MERIC Missouri Workforce 2019 Employer Survey.

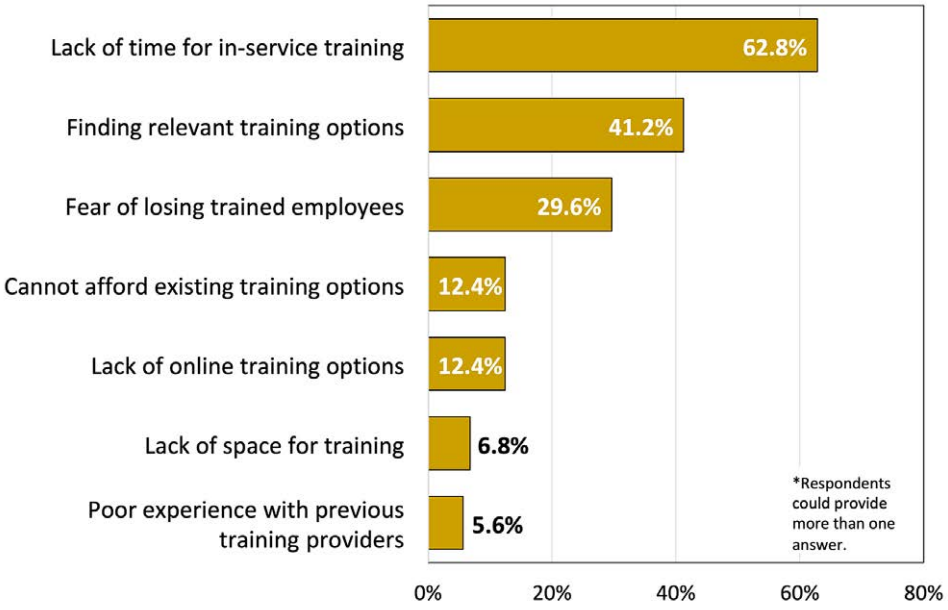
Food, agriculture and forestry employers rely more on OJT than any other method for training and education, and Figure 18 shows that this is consistent with Missouri employers generally (based on MERIC's 2019 Employer Survey). These employers are also less likely than employers statewide to use other methods to do incumbent worker training like offering flexible schedules to accommodate continuing education, in-house classroom training, vendor training and online courses.

Several factors limit the ability of employers to provide incumbent workers training. Most notably, Figure 19 shows that 63 percent of employers lack the time to do additional in-service training. Finding relevant training options that speak to specific needs—in terms of content, format or timing—was the second biggest training challenge for survey respondents. Almost a third of all respondents noted that the fear of losing trained employees was a training challenge, and this may speak to the tightness of the labor market during the study period.

Industry-recognized credentials signal value to employers, and stackable and connected certifications allow workers to build careers.

Many employers view industry-recognized certifications as stronger indicators than degrees about what workers are actually trained to do. In some instances, these certifications signal general work readiness. For instance, many Missouri communities have made extensive use of the ACT National Career Readiness Certificate (NCRC) as a way to help improve the efficiency of the hiring process.[40] Effective NCRC usage requires that employers invest in job profiles and make clear what they prefer (or even require) from applicants, as it is employer demand that gives these certifications value. Several food, agriculture and forestry employers indicated that they used WorkKeys assessments[41] to screen their applicant pool, and place workers in jobs where they will likely succeed.

Figure 19: Employer challenges when providing incumbent worker training



Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

Often, however, certifications and credentials are more specific to a given occupation or field. For example, within agriculture the Missouri Agribusiness Association supports the Certified Crop Advisor certification used by crop consultants.[42] Similarly, the Missouri Forest Products Association helps timber workers earn a Professional Timber Harvester (PTH) certification. Manufacturers also have many commonly utilized credentials from organizations such as the National Institute for Metal Workforce Standards (NIMS) and the American Welding Society (AWS).

In some instances, employers want certifications that signal more specific knowledge and skills. In the Kansas City region, it was noted that employers can find people with manufacturing experience but finding workers experienced in specialized fields (e.g.,

[40] https://jobs.mo.gov/ncrc
[41] ACT WorkKeys assessments test workers on workplace skills such as applied math, writing or finding information, and these assessments allow workers to receive their NCRC.
[42] https://mo-ag.com/cca-program/

food and animal health pharmaceutical manufacturing) was more difficult. To this end, Metropolitan Community College has worked with the Animal Health Corridor to support the Manufacturing Technician Level (MT1) certification.[43] This effort allows students to add additional curriculum to the existing MT1 certification program, so as to better demonstrate their ability to work in aseptic environments or within heavily regulated industries.

The most effective certifications are 'stackable' so that workers can progress toward a higher level of certification or an associate's degree in the same field.[44] This approach not only recognizes the need for continuing education, but allows workers—particularly non-traditional students (e.g., working adults, parents)—better access to post-secondary education and establish stronger career paths. Several key informants mentioned the need for stronger career paths in regards to occupations such as agricultural equipment operators, veterinary technicians, and production workers generally.[45]

Larger employers are more likely to collaborate with post-secondary institutions than small employers.

Above, Figure 18 showed that food, agriculture and forestry employers were less likely to engage with postsecondary educational institutions for structured education and training programs. For instance, community and technical colleges support apprenticeships by providing the formal education and training that compliments the work-based learning that apprentices receive on the job, but less than 1 in 5 survey respondents (18 percent) utilized apprenticeship programs. Moreover, only 10 percent of respondents worked with community colleges to provide customized training or education.[46]

Within food, agriculture and forestry, there were differences between larger firms (more than 50 employees) and small firms. Smaller firms lack the knowledge, resources, time or scale to fully take advantage of collaborative training opportunities. By contrast, larger firms were more likely to use customized training and/or apprenticeships due to greater training resources and more specialized needs. For example, several larger food manufacturers noted the contributions of their local community college partners in delivering customized workforce training related to workplace skills (e.g., team building, basic computer skills, etc.) or safety (e.g., OSHA, HAZMAT, etc.). A number of larger employers had invested in apprenticeships to create their own skilled workforce and stronger career pathways for their incumbent workers. These apprenticeships supported positions like industrial maintenance mechanics, custom applicators and wine makers, where employers viewed apprenticeships as a tool for reducing turnover and improving retention in key positions.

---

[43] http://manufacturingskillsinstitute.org/certifications/manufacturing-technician-level-1-skill-standards/

[44] Stackable Credential Policy: 50-State Scan**.** Prepared by B. Wilson, National Skills Coalition, December 2016.

[45] A number of states have stackable credential policies whereby they require post-secondary institutions to support stackable credentials and/or provide funding for post-secondary institutions to support stackable credentials. In Missouri, there is no formal state policy, but several state agencies promote the use of stackable credentials. For instance, the Department of Higher Education and Workforce Development's WIOA State Plan calls for job center staff to promote stackable credential programs, and many community colleges offer training programs with stackable credentials. The Department of Elementary and Secondary Education (DESE) has also begun providing guidance for identifying stackable credentials in the 2020-2021 school year.

[46] Missouri has made significant investments in apprenticeships, as Missouri had almost 15,000 active apprentices in roughly 475 programs in 2019. For more information: https://dhewd.mo.gov/apprenticeship_missouri.php

Employer engagement is a hallmark of community and technical colleges. These institutions help employers meet many of their immediate workforce needs. Employer input through program advisory boards can ensure that existing program curriculum remains relevant. Addressing programmatic gaps, however, can prove more challenging. Community and technical colleges must have sufficient student demand to make the program financially viable so as to cover costs such as instructors and equipment. Moreover, new programs should lead to a positive employment outcome for students through jobs that pay decent wages. As a result, community and technical colleges cannot respond to all identified workforce needs. Where these gaps exist, industry can play a greater role by providing equipment, recruiting students and providing funding for participation. As noted earlier, State Tech has partnered with companies like MFA and S&N Partners to create programs related to spray applicators and agricultural equipment repair, respectively.

These programs can help larger employers solve critical workforce challenges, but the impact for the industry is more limited because the programs emphasize a certain employer's needs or a specific technology platform (e.g., John Deere, Case IH). Addressing this issue requires greater coordination between industry, government and educational institutions to move these programs from being ad hoc initiatives to become more collaborative and systematic efforts to address pressing industry skill needs. Greater engagement and coordination, particularly among small employers, can increase the number of potential students and therefore achieve the numbers required to make these educational programs viable.

Higher education creates new workers and keeps skills current.

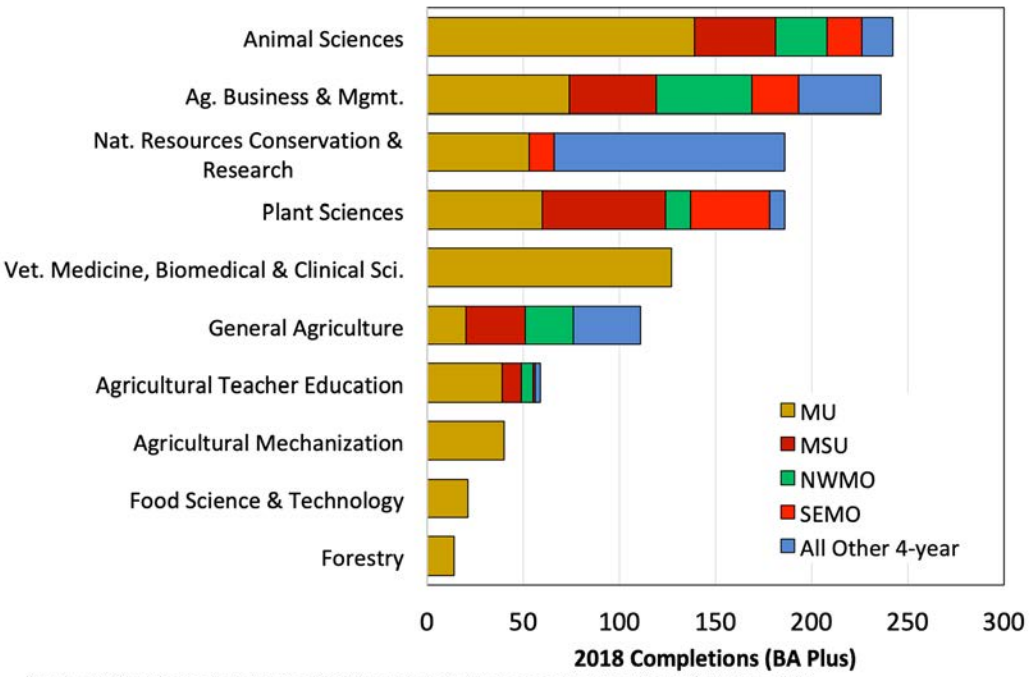
Only 1 in 8 food, agriculture and forestry jobs typically require some form of post-secondary education, but many of these jobs are critical scientific, technical and managerial positions. Graduates from Missouri-based post-secondary institutions fill many of these jobs, but a number of these graduates—particularly those completing 4-year and graduate degrees—will ultimately live and work outside of the state. Similarly, the state attracts workers from institutions outside Missouri that have strong agricultural programs, such as Iowa State University, University of Nebraska, or Kansas State University.

In 2018, Missouri's post-secondary institutions had 1,600 people complete certificates and degrees in programs directly related to agriculture, natural resources, and veterinary medicine.[47] Appendices E1 and E2 contain a full listing of the programs and the number of program completers at Missouri-based institutions in 2018. The University of Missouri accounted for 612 (38 percent) of these completed degrees and

[47] We identified 123 individual Classification of Instructional Programs (CIP) codes related to agriculture, natural resources and veterinary medicine. The data presented here include completer data for certifications, associates, bachelors, and graduate degrees. We drew these data from the US Department of Education's Integrated Post-secondary Education Data System (IPEDS), which collects and organizes information provided by public and private post-secondary institutions. The data are organized by Classification of Instructional Programs (CIP) codes. CIP codes allow for the tracking of completions by field of study at U.S. institutions of higher education and are available at varying levels of aggregation (e.g., 01-Agriculture, Agriculture Operations and Related Sciences; 01.09-Animal Sciences; 01.0905-Dairy Science). The 32 instructional programs with completers in Missouri are listed in Appendix E1 by 6-digit CIP codes.

certifications. Combined, Missouri State University (205), Northwest Missouri State University (148) and Southeast Missouri State University (97) were responsible for another 28 percent of degrees and certificates awarded in 2018.

Figure 20: Bachelors and Graduate degrees and certifications completions (2018)



Source: National Center for Education Statistics, Integrated Post-secondary Education Data System; EMSI

Figure 20 shows that there were 236 bachelors and graduate degrees in agricultural business and management awarded by Missouri-based institutions in 2018. These degrees prepare students for careers in agribusiness, both in and out of Missouri.[48] Many of these graduates will fill those occupations that are in-demand throughout the workforce (e.g., financial analysts, sales and marketing professionals, etc.), but an interest in agriculture can steer them towards careers in agribusiness.

The University of Missouri, Missouri State University, Northwest Missouri State University and Southeast Missouri State University also train the vast majority of graduates pursuing degrees in animal and plant sciences. Animal science degrees prepare students for careers in herd management or meat production, whereas plant science graduates may pursue careers in crop management, agribusiness or biotechnology. These graduates not only support Missouri's agribusiness industries, but in some instances represent the next generation of farmers and farm operators who will lead an increasingly sophisticated approach to farming.

The state's community and technical colleges also play a critical role, particularly in supporting the state's manufacturers. In 2018, over 2,100 students completed certificates and other certifications or associate's degrees in fields related to

[48] It is worth noting that not all graduates from Missouri-based institutions remain in the state upon graduation. For instance, 40 percent of Southeast Missouri State University's agricultural students are from Illinois because out of state tuition at SEMO is still less than in-state tuition than the University of Illinois, Urbana-Champaign or Southern Illinois University-Carbondale. Many of these students tend to return home to Illinois.

engineering technology, precision production, or industrial maintenance at the state's public and private community and technical colleges. However, completers from programs more specific to agriculture and forestry are limited.

Figure 21 shows the community colleges where students completed agriculture, natural resources and veterinary degrees in 2018. The greatest number of completers were in agricultural business and management, and veterinary technician and assistant programs. Agricultural business and management degrees can prepare students to work on their family farm or in agribusiness, but in many cases it prepares transfer students for bachelor's programs at 4-year institutions. Veterinary technician and assistant programs are another relatively popular and this reflects greater student demand.

Figure 21: Certification and 2-year degree completions (2018)

College	General Agri.	Ag. Bus. & Mgmt.	Ag. Mech.	Viticulture & Enology	Applied Hort. & Hort. Business Services	Nat. Resources Cons. & Research	Forestry	Vet. Tech. & Vet. Assistant
Crowder College		26						13
North Central Missouri College		28						
Ozarks Technical Community College					16	11		
Metropolitan Community College-Kansas City								26
Midwest Institute								22
State Technical College of Missouri			13		8			
St. Louis Community College					16			
Jefferson College								14
Missouri State University-West Plains	10			3				
State Fair Community College		12						
Three Rivers College			3				4	
Mineral Area College		6			1			

Source: National Center for Education Statistics, Integrated Post-secondary Education Data System; EMSI

Beyond these two program areas there are pockets of specialization around the state. For instance, State Tech and Ozark Technical Community College have turf and landscape management programs, St. Louis Community College has a horticulture program, and Three Rivers College has a nascent precision agriculture program. Three Rivers College also has a forestry program that prepares students to transfer to study Natural Resource Science and Management with an emphasis in Forest Resources at the University of Missouri. MSU-West Plains hosts the VESTA (viticulture and enology) program, which is the state's only program that specifically focuses on fermentation sciences.

Other states have some more specialized programs, from which Missouri institutions may wish to learn. For instance, the Midwest Center for Precision Agriculture at Parkland College in Illinois is a leading college for precision agriculture. Garden City Community College has a program for Food Science-Meat Production that supports meat producers in Western Kansas. North Carolina is known for its robust community college system and there are food sciences programs at Asheville-Buncombe Technical

Community College and Blue Ridge Community College, with the latter program focused on the region's growing brewing industry. Also in Western North Carolina, Haywood Community College's Forest Management program is one of a limited number of community colleges whose programs are accredited by the Society of American Foresters.

A longer-term goal may be to establish 'Centers of Excellence' at different community colleges (or groups of colleges). These centers would develop state of the art curricula, acquire world class technologies, and build linkages with a national network of experts to support the implementation of world class training throughout the state. In the interim, strengthening the connections between employers and post-secondary institutions can lead to better outcomes for both employers and students. The growing use of apprenticeships is representative of this, as the specialized knowledge comes from the OJT provided from the employer while the participating college provides the education and technical knowledge and therefore there in not a need to invest in an expensive specialized program.

Moreover, stronger access to these educational programs can benefit both students and employers. Many programs require hands on learning, but many elements of those projects can be taught remotely. Distance learning is a growing trend within higher education and this can benefit students throughout the state as it potentially enables, for example, a student in Southeast Missouri to take advantage of programs in Northwest Missouri. If nothing else, the challenges caused by COVID-19 will only accelerate the use of distance learning in higher education. That said, accessing distance education requires reliable access to broadband internet which is a challenge facing many rural communities in Missouri. In addition, to reiterate an issue raised above, these certificate and degree programs must all be connected and stackable so they prepare students and workers for careers, not just jobs.

Basic business and management skills are critical for the viability of careers and enterprises.

In addition to meeting technical training and education needs, numerous interview and focus group participants identified basic business and management skills as a critical workforce need. Many food, agriculture and forestry-related businesses are small businesses, but these business owners are often not formally trained to run a business. As a result, these business leaders frequently learn basic business skills—understanding financial statements, how to properly price services, or basic marketing—through experience.

Developing these skills is vital for farms, landscaping businesses or veterinary offices to become viable business enterprises. Industry organizations sometimes offer this type of business training through continuing education, but these topics compete for time with other types of training. In addition, business owners often not aware of, or know how to access, business support services—such as those offered by the Missouri Small Business Development Center or Missouri Enterprise—that are specifically designed to help small business owners.

Management and leadership skills are also critical elements for developing careers in food, agriculture and forestry. As noted earlier, the survey respondents identified leadership and supervisory skills as the second most difficult skill to find, behind only reliability and work readiness. A wide array of jobs require these kinds of skills, ranging from researchers moving into a greater leadership role in a technology company or production workers assuming positions as first-line supervisors. There is also a common need for mentoring—at the firm, community, or industry level—to ensure that workers are able to develop these business and management skills.

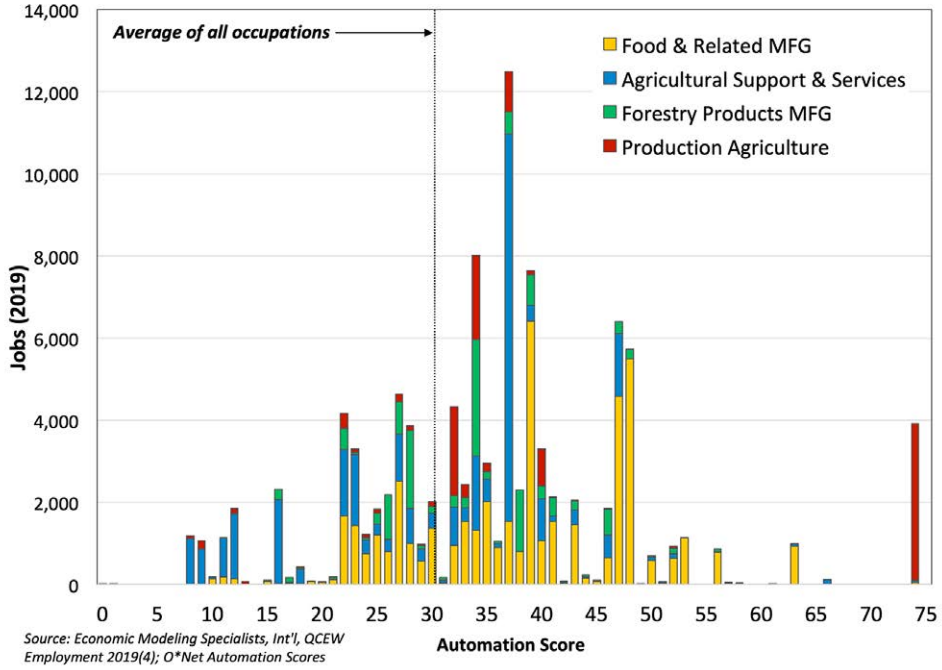
4.4 Greater use of automation and technology can alter workforce needs

A down economy may alleviate some of the challenges to fill positions, but once the economy recovers these challenges will persist. Adopting new technologies and automated processes has allowed some food, agriculture and forestry employers to overcome their staffing challenges. These technologies increase productivity and reduce overall headcount, which in turn eases the pressure to find workers. Investing in new technology and automation can create many opportunities, but it does not come without new workforce challenges. This section reviews the impact of increased automation on the state's food, agriculture, and forestry workforce.

Automation affects occupations differently.

Figure 22 shows the distribution of Missouri's food, agriculture and forestry jobs by degree of automation. These automation scores—drawn from the O*Net database—range from 0 (not at all automated) to 100 (completely automated).[49] Roughly 70

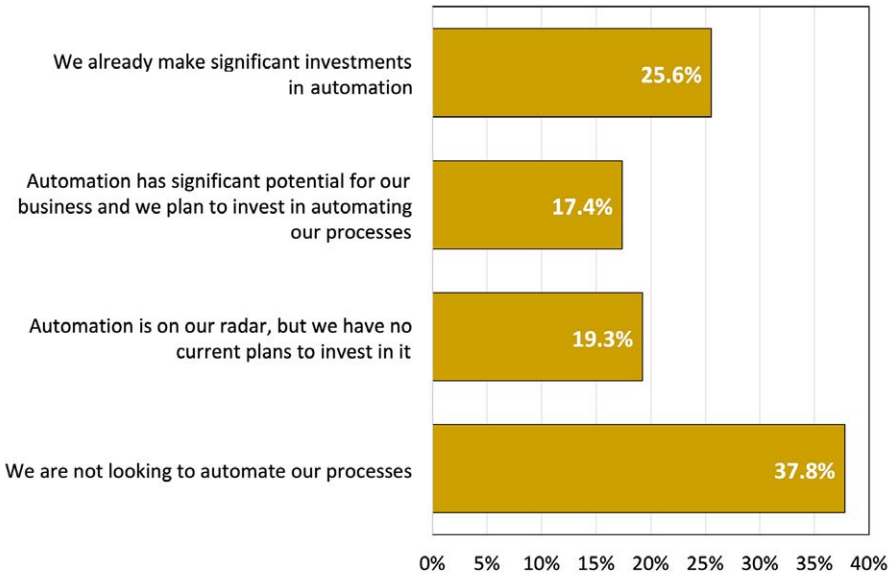
Figure 22: Missouri's food, agriculture, and forestry jobs by automation score



[49] In gathering information about each occupation, the O*Net Survey asks "How automated is this job?" Each job is then rated on a scale of 0-100, where not at all automated-0, slightly automated-25, moderately automated-50, highly automated-75, and completely automated-100.

percent of Missouri's food, agriculture and forestry jobs are above average in terms of their degree of automation (the average for all jobs is 29). That said, the degree to which occupations can be automated varies widely. For instance, within production agriculture farmworkers and laborers who work with livestock and animals (Automation Score: 32) have significantly less automated jobs than crop farmworkers and laborers (74).

Figure 23: Survey respondent sentiments about internal process automation



Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

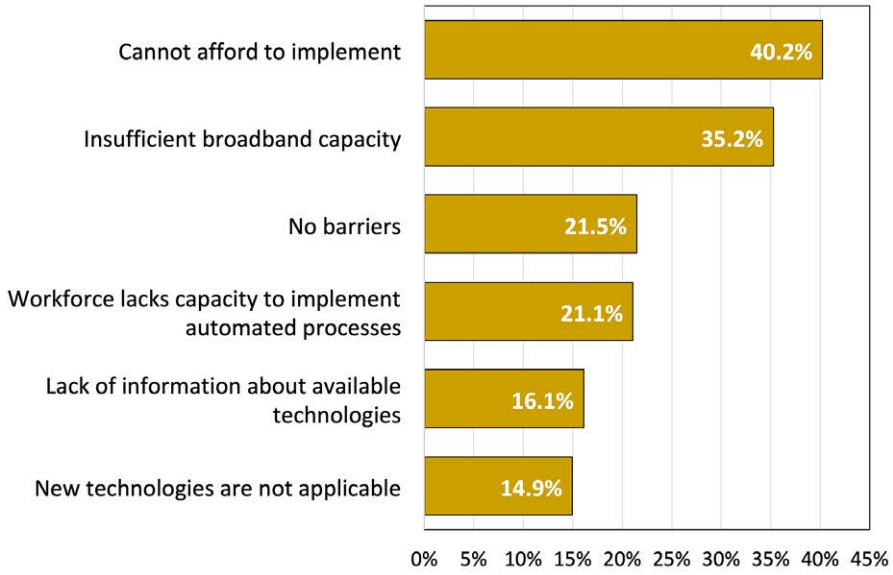
More knowledge-driven and service-oriented jobs tend to be less automated. Veterinary services jobs—veterinarians (8), veterinary assistants (16), and veterinary technicians (23)—all have below average levels of automation. Similarly, jobs that require specialized skills and/or problem-solving ability like farm equipment mechanics (8) and tree trimmers (11) are also less automated. Figure 22 also shows more manufacturing-related industries have larger numbers of occupations more greatly impacted by automation.

Employers take different approaches to automation and technology.

Among survey respondents, sentiments toward automation varied widely. Figure 23 shows that a quarter of respondents already make significant investments in automation, while another 17 percent of employers were planning to invest in process automation. Approximately 1 in 5 respondents were considering greater use of automation, but had no current plans to move forward with those investments. Almost 38 percent of employers were not looking to automate their processes.

Figure 24 shows the barriers to adopting new technologies and processes. Over 40 percent of respondents indicated that they cannot afford to make these investments. This is likely a small business problem. Among the survey respondents that had no plans to automate, roughly two-thirds were in businesses with fewer than 10 employees. Small businesses not only lack the resources to automate, but they have less margin for error in the event that those new technology investments do not produce the expected return.

Figure 24: Barriers to greater adoption of automated technologies and processes



**Respondents could provide more than one answer*
Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

Insufficient broadband capacity prevented 35 percent of survey respondents from adopting more automated technologies and processes. These barriers present themselves in several ways. For instance, PumpTrakr is an app—developed in Southeastern Missouri in partnership with Codefi Labs in Cape Girardeau—designed to improve irrigation management. It helps farm operators manage their irrigation pumps' activity, fuel levels, and maintenance issues. The ability to monitor and track this information can help farm operators and managers save time and money. However, farmers cannot easily access this information on their phone if there is insufficient broadband connectivity. Similarly, farmers who use sensors to track animal health or movement also need sufficient broadband capacity to efficiently transmit that information to the technology and service firms who process these data and turn it into actionable information. Across the state, insufficient broadband can also hinder the ability of companies to manage different units or provide online professional development to a distributed workforce. Insufficient broadband also hurts online agricultural education; it was pointed out that a number of Southeast Missouri State University students in Southeast Missouri had to go to one of the regional campuses in Sikeston or Kennett to access online offerings and resources because they lacked sufficient connectivity in their homes.

Insufficient broadband capacity prevented 35 percent of survey respondents from adopting more automated technologies and processes.

Firms also adopt new technologies and automated processes differently. Many advanced manufacturers—particularly large manufacturers—continuously invest in new equipment and technology, but smaller manufacturers make more modest investments. Before smaller manufacturers can invest in new technology, they need to know which technologies will yield the greatest benefits, how these new technologies fit within their production processes, and whether the returns in the new technology will be worth the

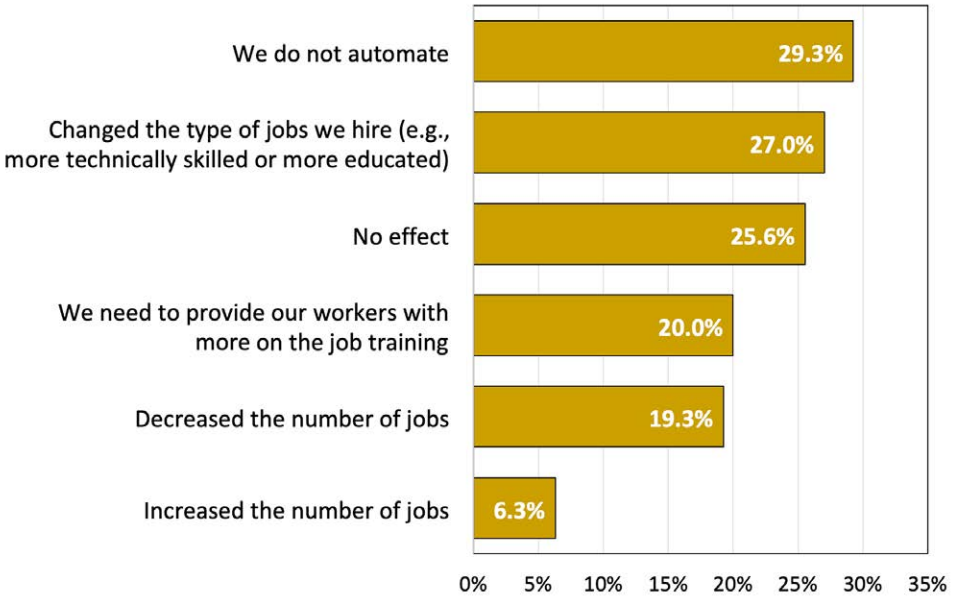
investment. Not all managers and operators have this business acumen in-house to confidently make these decisions and may require the assistance of management consultants or business support providers like Missouri Enterprise or the Missouri Small Business Development Center.

Scale matters to agricultural producers too, as larger producers are better positioned to invest in advanced equipment or services. However, they remain cautious about adopting new agricultural innovations (e.g., new varieties of cover crops, robotic milking systems), so innovators must demonstrate that their solution works before other producers will adopt them. The challenge facing inventors is to find a willing partner to test their innovations. BioSTL's Early Adopter Grower Innovation Community (EAGIC) program[50] is one program designed to address this issue. The EAGIC program works as an honest broker for farmers with specific challenges, and connects them with vetted innovators with solutions that address those needs. These programs allow Midwest farmers to become early adopters of technology.

Increased use of automated processes and technologies can change workforce demand.

Technology and automation not only changes business processes but for some firms it can also change their overall workforce needs by, for instance, increasing the overall skill level of their workforce. Figure 25 shows that for 27 percent of survey respondents the greatest impact of automation was an increased need to hire more technically-skilled or educated workers; another 20 percent had to provide their workers with more OJT. Increased automation led to decreased headcount for an additional 19 percent of survey respondents.

Figure 25: Greatest impact of automation on respondent business



**Respondents could provide more than one answer*
Source: MU Extension Food, Agriculture and Forestry Employer Survey, Jan.-March 2020

[50] https://eagic.org/About

Key informants and focus group participants supported these findings. For instance, one stakeholder noted that their company installed robotic stackers into several feed mills. This technology reduced their headcount, made the remaining jobs less physically demanding and safer, and improved worker morale. Several manufacturers cited these kinds of investments (e.g., automated material moving equipment) as an initial way to introduce more labor-saving technology into their process.

In food manufacturing automation can reduce headcount, but it comes with other challenges. One poultry processor prefers deboning chickens by hand because it does less damage to the meat and produces greater yields than machines doing the same work. However, the inability to find enough workers to perform these tasks led the company to invest in automated machinery regardless. Greater automation also increases the need to hire and retain more skilled workers—particularly amongst their maintenance staff. After making significant investments in automation, one large meat processor supported these investments by partnering with its local community college to develop an apprenticeship program to train and retain maintenance staff.

The COVID-19 pandemic has forced food manufacturers to reconsider the costs and benefits associated with investments in technology and automation. Food manufacturers need to rethink the physical layout of their production activities to allow for greater spacing between workers. The trend in food manufacturing has been moving toward greater levels of automation, but the COVID-19 pandemic has very much accelerated these trends. Moreover, it has also generated greater interest from investors and other manufacturers looking to develop and create the equipment necessary to support increased automation.

Food manufacturers have been moving toward greater levels of automation, but the COVID-19 pandemic has very much accelerated these trends.

Increased technology also changes the way that people use information. For instance, the ability to use drones and other remote sensing technologies that monitor livestock intake, plant diseases, animal health, movements, pasture quality or milk production can transform the way that people go about farming, logging or raising livestock. This technology can create a seemingly infinite amount of data, but those data are useless if they cannot be turned into actionable information for the end users.

To this end, programs like Southeast Missouri State University's agricultural systems management program requires students to supplement plant and animal sciences and agribusiness coursework with additional classes related to spatial analysis in GIS, precision agriculture, and/or unmanned aircraft systems or drones. In addition to this technical knowledge, educators, crop consultants, and investors all noted that communication skills were increasingly vital. This was especially true for forward facing staff that must translate and communicate all this information to farmers and farm managers, so that they can effectively use it in their farm or herd management strategies.

5. MOVING FORWARD

In spite of the current COVID-19 related economic disruptions, Missouri's food, agriculture and forestry industries are forecast to have steady employment over the next decade. The occupational projections show that between 2019 and 2029, food, agriculture and forestry employers will have about 13,000 annual openings. Approximately 7 out of 8 wage and salary jobs within these industries do not currently require post-secondary education, so many positions need reliable manual laborers with a basic mechanical aptitude. This demand can bring food, agriculture and forestry-related employers into direct competition with employers in other industries, such as general manufacturing, construction, and distribution and logistics. Similar competition occurs for occupations like truck drivers and industrial machinery mechanics, as well as white collar occupations in sales or management.

Other jobs are more unique to food, agriculture and forestry (e.g., custom applicators, farm equipment mechanics, winemakers), and therefore require workers to possess more specialized knowledge and skills. Employers must find a way to create a sufficient number of qualified workers to fill these positions. Collaborative efforts with training and education providers—through customized training, greater use of industry-recognized credentials, apprenticeships, or direct employer support for degree programs—can establish pipelines of trained employees.

In addition to creating and competing for current and future workers, this research identified other workforce challenges that Missouri must address Missouri to successfully develop a next-generation agricultural workforce. These challenges include—encouraging new workers to consider careers in food, agriculture, and forestry; promoting and supporting ongoing training and education; and encouraging adoption of new technologies and automated processes.

Missouri's private sector, state government, and education leaders will use the information presented in this report to develop a long-term workforce development strategy for Missouri's food, agriculture and forestry industries. Even in an era of constrained public resources, these leaders can address the challenges described above through greater communication and collaboration, and taking steps to:

- **Expand efforts to promote food, agriculture and forestry careers and technical** education. Agriculture and CTE prepares and exposes students to many careers in food, agriculture and forestry. Missouri can increase the pool of qualified students entering the workforce pipeline by strengthening these programs through greater promotion, equipment donations, or connecting students and teachers to work-based learning opportunities. Throughout these efforts, youth groups such as FFA and 4-H will be vital partners, so success will rely upon effectively engaging these groups whose members are predisposed to have an interest in agriculture. These youth groups only touch a fraction of high school students, so be made to promote agricultural and CTE-related careers to more urban and suburban students. These efforts should also explore ways to reduce attrition in critical professions such as Agriculture and CTE teachers.

- **Organize statewide or regional sector strategies related to food, agriculture and forestry.** Sector strategies are systematic approaches to workforce development that target a specific industry or set of occupations. The Workforce Innovation and Opportunity Act (WIOA) allows local workforce boards to use WIOA funding to develop, and execute, sector strategies. These strategies involve partnerships between organizations—such as workforce and economic development agencies, education and training providers, employers, employer associations, and organized labor—to develop and implement the resulting strategies. By collaborating, these partners can develop employer-driven solutions to their common workforce challenges. This work might identify and build consensus support for public-private investments in 'Centers of Excellence' at community and technical colleges across the state. By fostering deeper—and importantly more systematic—connections between employers and a broader set of partners, Missouri can address more long-term challenges such as constructing talent pipelines. Missouri might also consider several existing models for addressing these challenges; for instance, the US Chamber of Commerce Foundation's Talent Pipeline Management program which applies lessons from supply chain management to workforce challenges.[52] These efforts might focus on industries such as meat processing or forest products manufacturing, but ultimately the willingness of employers to engage will dictate the focus areas.
- **Promote existing workforce programs and services.** There are already a number of available programs and services to address the many challenges facing Missouri's food, agriculture and forestry employers including—career readiness certifications[53], apprenticeships[54], or incumbent worker training support programs such as the Fast Track Workforce Incentive Grant[55] or Missouri One Start which supports customized incumbent worker training.[56] Larger firms are more likely to take advantage of these services because they have greater resources or dedicated human resources departments. Consequently, specific efforts should be made to promote relevant service and training programs to smaller food, agriculture and forestry firms. Basic business and management skills were another commonly identified area of workforce need, so further efforts should be made to connect small employers to the services offered by support organizations such as the Missouri Small Business Development Center, Missouri Enterprise or university extension services. Relevant industry or commodity groups should play key roles in disseminating this information and connecting employers to these resources.

[51] https://www.aspeninstitute.org/programs/workforce-strategies-initiative/sector-strategies/
[52] https://www.uschamberfoundation.org/talent-pipeline-management
[53] https://jobs.mo.gov/ncrc
[54] https://jobs.mo.gov/content/moapprenticeships
[55] This program encourages adult workers to pursue a degree, certificate or industry-recognized credentials in areas of critical need for the state. Appendix E1 indicates which agricultural specific programs qualify for this program. More information is available at: https://dhewd.mo.gov/initiatives/fast_track.php
[56] https://missourionestart.com/

- **Invest in rural communities.** Several factors create difficulties for food, agriculture and forestry workers attracting and retaining workers, especially in the state's more rural communities. Investments in the state's more rural communities will not only support these employers, but also these communities. Notably, focusing investments on expanding and strengthening these communities' broadband infrastructure will not only allow firms to more effectively utilize technology, deliver distance learning, and increase their overall quality of life.

Developing a next generation workforce for Missouri's food, agriculture and forestry industries will not happen overnight. However, this transformation can occur with strategies that address both short-term challenges and long-term needs.

6. APPENDICES

Appendix A: Project methodology

This workforce needs assessment study used multiple methods—analysis of labor market information, an employer survey and industry and stakeholder focus groups and interviews—to assess the current and future needs of Missouri's food, agriculture and forestry industries. However, defining food, agriculture and forestry is a critical first step in this analysis. To this end, the 2016 Economic Contributions of Missouri Agriculture and Forestry report[57] informed this workforce needs assessment in two important ways.

First, it gave us an initial set of 90 NAICS (North American Industry Classification System) industries[58] to define the state's food, agriculture and forestry industries. We subsequently included 8 more food, agriculture and forestry-related industries.[59] The economic contributions study also organized these industries into four broad industry segments—production agriculture, agricultural support and services, food and beverage manufacturing, and forestry and wood products—that allow us to better capture the diversity of activities within this broadly defined set of industries. A complete list of the 98 industries included in this study, by group, is available in Appendix B.

Nevertheless, this study differs from the economic contributions study in several important ways. Economic contributions studies seek to account for the full range of economic impacts associated with a given industry or set of industries. As a result, those studies consider the direct, indirect and induced economic effects of those activities and includes both employee and self-employment income.[60] By contrast, our analysis focuses primarily on wage and salary workers.[61] Wage and salary jobs are the jobs in firms that have an actual workforce, and by focusing on the jobs in these firms we can make assumptions about the staffing needs in their respective industries.

[57] Economic Contributions of Missouri Agriculture and Forestry**.** Prepared by Decision Innovation Solutions, December 2016.
[58] The industries presented in this section are based on the North American Industry Classification System (NAICS). NAICS provides a way to classify business establishments for the purpose of data collection and analysis. They describe an establishment's primary line of business (e.g. wood pallet and container manufacturing, breweries, veterinary services). For more information on NAICS and NAICS definitions, see: http://www.census.gov/eos/www/naics/
[59] These additional industries include: Retail bakeries (NAICS 311811), commercial bakeries (NAICS 311812), perishable prepared foods (NAICS 311991), truss manufacturing (321214), farm and garden machinery and equipment merchant wholesalers (NAICS 423820), other farm product raw material merchant wholesales (NAICS 424590), farm supplies merchant wholesalers (NAICS 424910), and farm product warehousing and storage (NAICS 493130).
[60] Direct economic effects capture the value of production of businesses. Indirect economic effects represent supply chain spending by those businesses. For example, breweries purchase barley and hops from farmers and/or wholesalers, packaging materials, transportation services and a wide range of professional services. Induced economic effects estimate the impacts of household income spending for goods and services. When added together, the direct, indirect, and induced economic effects represent the "multiplier" effect.
[61] Wage and salary workers are employees that receive wages, salaries, commissions, etc. from their employers for their work. This employment is often referred to as a 'covered employment' because workers in these jobs are covered by the unemployment insurance program. This is the primary way that the US Bureau of Labor Statistics measures employment, as their data are drawn from the UI program's administrative records.

This is not to say that self-employment is unimportant; self-employment is an important source of economic activity, particularly within the food, agriculture and forestry.[62] However, sole proprietors face different workforce challenges (e.g., basic business knowledge or entrepreneurial skills) than firms that must fill a broad range of positions.

Analyzing industry staffing patterns reveals key occupational trends.

The employment trends within the 98 selected NAICS industries provide a broad indication of labor demand, but they do not provide information about the demand for specific jobs. Industry (NAICS) data can tell us what companies make (e.g., dairy product manufacturing), but we need to use occupational data (e.g., agricultural equipment operators, veterinarians) to better understand what employers need workers to do.[63] The US Bureau of Labor Statistics' industry-occupation staffing pattern matrix allow us to identify the types of occupations found in each industry or set of industries, by showing the distribution of occupations within a given industry.

As a stylized example, if 100 people work in crop production (NAICS 111000), we can assume that 21 are farmers, 49 are farm laborers, and 5 are agricultural equipment operators.[64] This information allows us to determine the largest occupations within the different segments of food, agriculture and forestry and this group of industries as a whole. Once these occupations have been identified, we can examine current and future employment, wage trends, and the educational requirements for key food and agriculture-related occupations. A complete listing of the occupations that have more than 100 jobs in Missouri's food, agriculture and forestry industries can be found in Appendix C. Our employment data and projections were drawn from Economic Modeling Specialists International (EMSI), a nationally recognized proprietary vendor of labor market information.[65]

It is important to note that a number of people working in agricultural jobs do not work in one of the 98 NAICS industries included in our definition of food, agriculture and forestry. For instance, state government employs a number of veterinarians and foresters but we have not included state government in our definition because those jobs represent a very small fraction of state government activities and employment. In addition, there are not separate industry classifications for important agricultural research firms including plant sciences companies like Bayer and animal health

[62] We recognize that there are significant numbers people involved in production agriculture that do not hold wage and salary jobs. For instance, data from the US Bureau of Economic Analysis, shows that there were approximately 86,500 farm proprietorships in the state of Missouri in 2018. Moreover, the US Census Bureau's non-employer statistics—which counts businesses with no paid employees and receipts greater than $1,000 per year—showed that Missouri had roughly 6,000 non-employers in non-farm agricultural support activities, 7,700 non-employers in landscaping services, and over 700 non-employers each in both food manufacturing and wood products manufacturing in 2017. Nevertheless, this report focuses on the occupations within firms that have employees.

[63] The occupations presented in this report are based upon the Standard Occupational Classification (SOC) system. Whereas the NAICS system identifies an establishment's primary line of business (e.g., animal production, farm management services, poultry processing), SOC codes are used to collect and analyze data about what workers actually do (e.g., farmers, ranchers, and other agricultural managers; Heavy and tractor-trailer truck drivers; Meat, poultry, and fish cutters and trimmers, etc.). More information about the SOC system can be found on the US Bureau of Labor Statistics website at: http://www.bls.gov/SOC

[64] As an example, the staffing matrix for Crop Production can be found here.

[65] Unless noted otherwise, the analysis uses Economic Modeling Specialists International (EMSI) representation of U.S. Bureau of Labor Statistics data. The EMSI data combine U.S. Bureau of Labor Statistics employment payroll data from its Quarterly Census of Employment and Wages. EMSI then estimates data where BLS privacy standards do not allow it to disclose publicly. These estimates allow us to get greater industry and geographic data. Moreover, EMSI provides a number of labor saving tools such as producing data for the staffing pattern analysis.

companies like Boehringer Ingelheim.[66] Rather these companies are often found in NAICS industries such as pharmaceutical products manufacturing and life sciences research and development, where a much greater proportion of the overall employment are in firms that are not involved in food, agriculture and forestry.

Knowing the extent to which food, agriculture and forestry industries employ people in these key occupations allows us to better understand how these employers compete with other industries for workers in key occupations. For instance, food, agriculture and forestry-related industries employ more than 90 percent of the state's veterinarians, but less than 5 percent of Missouri's heavy and tractor-trailer truck drivers. As a result, these employers are the primary source of employment for veterinarians, but must compete for truck drivers with construction, manufacturing and logistics employers.

Where occupations require workers with post-secondary education, we can also consider completers from relevant programs at Missouri-based post-secondary institutions using data available through the National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS). This information will identify both the state's agricultural, natural resources and veterinary programs and how many students are completing programs and are potentially able to enter the workforce. Combined, these secondary data analyses will provide greater understanding of the most commonly sought jobs, skills and certifications within each segment of Missouri's food, agriculture and forestry industries. These analyses show us the pattern of current and projected demand, but more qualitative analyses are necessary to better understand the forces underlying these patterns of demand.

The industry survey generated primary data about perceptions of different workforce issues.

The research team also conducted a primarily electronic survey of Missouri's food, agriculture and forestry employers to complement the analysis described above. The survey results provide information not easily drawn from secondary data sources, including:

- Individual business characteristics,
- Current vacancies and firm growth trends,
- Recruitment and retention practices,
- Training and skill development, and
- Adoption of technology and automated processes.

The survey was open from January 6, 2020 through March 15, 2020 and was promoted through industry associations, commodity organizations, Extension faculty, public meetings, social media and email distribution lists. The majority of respondents took the survey online, with half of all respondents opening the survey after receiving information in an email. The survey was distributed directly to 1,878 email addresses and received responses from 217 (11.6 percent). Another 40 percent of survey responses came from respondents clicking on the survey link generically by visiting websites or

[66] These firms may fall in NAICS industries such as Research and Development in the Physical, Engineering, and Life Sciences (NAICS 541715) or Pharmaceutical Preparation Manufacturing (NAICS 325412), where the vast majority of employment is not related to food, agriculture of forestry.

viewing on social media. Employers filled out 33 paper surveys at their businesses, agricultural trade shows or industry trainings.

Based on data from the Missouri Economic Research and Information Center (MERIC), Missouri's labor market information agency, the State of Missouri has 6,695 business establishments within the categorization of food, agriculture and forestry employers. Using standard social science assumptions of a 90 percent confidence interval and a 5 percent margin of error, the survey needed at least 261 responses from businesses across the state. The survey included a screening question to exclude businesses that did not employ workers within the targeted industries in Missouri. There were 104 respondents that did not meet this qualification, which left 326 valid responses. Responses were received from 103 of the state's 114 counties and one independent city (St. Louis). Therefore, the response rate indicates a valid sample of Missouri food, agriculture and forestry employers, but the ability to provide robust comparisons between industry segments, firms of different sizes, and firms in metro/non-metro counties is limited.

A summary of the responses to each survey question can be found in Appendix D.

Key informant interviews provided explanatory details about workforce issues and employer priorities.

In addition to the staffing pattern analysis and employer survey, the project team also sought employer and stakeholder input through a series of interviews and focus groups. Focus group meetings were held in Kansas City, Macon, St. Joseph, St. Louis, Sikeston, and Springfield. However, recognizing that many key informants were not able to attend a scheduled focus group, the project team also conducted a number of individual phone and in-person interviews with employers and key stakeholders from all segments of the state's food, agriculture and forestry industries. This allowed more detailed and in-depth conversations with individuals. In total, the project team spoke to over 70 employers and key stakeholders through individual conversations and focus groups.

These conversations were vital to the research effort as they allowed us to better understand issues not readily apparent in the data, and enabled us to better interpret and validate the quantitative research findings. These interviews and focus groups covered a wide variety of topics, including:

- Current and future (10-year) workforce challenges,
- Most in-demand and difficult to fill jobs,
- Where employers currently have success finding workers,
- The manner in which companies engage youth and other potential future workers,
- How employers invest in training and skill development, and
- The nature and extent to which employers use automation and technology to alleviate their workforce challenges.

This mixed methods approach allowed us to identify occupations with both the greatest volume of demand and the most pressing needs. Moreover, our approach will allow us to better understand the current and future workforce priorities and challenges of Missouri's food, agriculture and forestry workforce.

Appendix B: Industries included in food, agriculture, and forestry

NAICS	Industry	2014 Jobs	2019 Jobs	Change 14-19	2019 Location Quotient	Projected Compound Annual Growth (19-29)
	Production Agriculture					
111000	Crop Production	5,004	4,668	-337	0.45	0.8%
112000	Animal Production	4,398	4,742	344	0.94	0.5%
113110	Timber Tract Operations	20	13	-7	0.23	-0.2%
113210	Forest Nurseries & Gathering of Forest Products	14	22	8	0.59	4.1%
113310	Logging	156	222	66	0.24	2.9%
114111	Finfish Fishing	0	0	0	0.00	
114112	Shellfish Fishing	0	0	0	0.00	
114119	Other Marine Fishing	0	<10		0.45	
114210	Hunting & Trapping	33	16	-17	0.45	4.3%
115111	Cotton Ginning	272	263	-8	1.94	-1.7%
115112	Soil Preparation, Planting, & Cultivating	365	353	-12	0.62	2.6%
115113	Crop Harvesting, Primarily by Machine	13	30	17	0.12	5.2%
115114	Postharvest Crop Activities (except Cotton Ginning)	840	932	92	0.53	2.0%
115115	Farm Labor Contractors & Crew Leaders	49	84	36	0.02	5.7%
115116	Farm Management Services	384	462	78	1.23	2.8%
115210	Support Activities for Animal Production	599	616	17	1.05	1.2%
115310	Support Activities for Forestry	41	93	53	0.27	6.0%
	Agricultural Support & Services					
212393	Other Chemical & Fertilizer Mineral Mining	17	29	11	0.53	6.2%
325199	All Other Basic Organic Chemical MFG	1,336	1,485	149	1.96	0.4%
325311	Nitrogenous Fertilizer MFG	224	157	-67	1.01	-0.3%
325314	Fertilizer (Mixing Only) MFG	236	135	-102	0.80	-3.5%
325320	Pesticide & Other Agricultural Chemical MFG	1,256	1,485	229	5.94	-0.7%
333111	Farm Machinery & Equipment MFG	344	408	64	0.35	2.5%
333112	Lawn & Garden Tractor & Home Lawn & Garden Eqpt MFG	227	196	-31	0.58	-3.5%
333241	Food Product Machinery MFG	321	400	80	1.07	-3.1%
423820	Farm & Garden Machinery & Eqpt Merchant Wholesalers	3,736	3,418	-319	1.77	0.3%
424590	Other Farm Product Raw Material Merchant Wholesalers	116	124	8	0.73	0.2%
424910	Farm Supplies Merchant Wholesalers	3,660	3,836	175	1.71	0.4%
493130	Farm Product Warehousing & Storage	282	269	-13	1.27	1.3%
541940	Veterinary Services	6,322	7,459	1,137	1.00	1.5%
561730	Landscaping Services	12,174	13,216	1,042	0.88	0.8%
	Forestry & Wood Products Manufacturing					
321113	Sawmills	2,153	2,057	-96	1.31	-0.6%
321114	Wood Preservation	85	96	12	0.51	2.3%
321213	Engineered Wood Member (except Truss) MFG	77	41	-37	0.31	0.8%
321214	Truss MFG	418	487	70	0.81	-0.1%
321219	Reconstituted Wood Product MFG	11	42	30	0.15	1.7%
321911	Wood Window & Door MFG	151	177	26	0.18	2.0%
321912	Cut Stock, Resawing Lumber, & Planing	581	394	-187	1.50	2.1%
321918	Other Millwork (including Flooring)	1,043	1,190	148	1.68	0.2%
321920	Wood Container & Pallet MFG	2,450	2,614	164	2.23	0.8%
321992	Prefabricated Wood Building MFG	114	155	41	0.52	1.5%
321999	All Other Miscellaneous Wood Product MFG	273	343	70	0.72	1.4%
322121	Paper (except Newsprint) Mills	188	182	-7	0.18	0.3%
322211	Corrugated & Solid Fiber Box MFG	2,102	2,522	420	1.36	0.5%
322212	Folding Paperboard Box MFG	649	616	-33	1.15	-0.1%
322219	Other Paperboard Container MFG	983	1,117	134	2.29	0.8%
322220	Paper Bag & Coated & Treated Paper MFG	859	641	-218	0.59	-2.5%
322230	Stationery Product MFG	590	593	4	1.90	2.6%
322291	Sanitary Paper Product MFG	1,025	891	-133	1.66	-2.1%
322299	All Other Converted Paper Product MFG	286	356	70	1.07	3.0%
333243	Sawmill, Woodworking, & Paper Machinery MFG	121	138	18	0.54	0.9%

NAICS	Industry	2014 Jobs	2019 Jobs	Change 14-19	2019 Location Quotient	Projected Compound Annual Growth (19-29)
	Food & Beverage Manufacturing					
311111	Dog & Cat Food MFG	2,680	3,549	869	6.68	3.5%
311119	Other Animal Food MFG	1,276	1,540	264	2.30	1.2%
311211	Flour Milling	604	542	-63	2.11	-0.3%
311212	Rice Milling	88	27	-61	0.28	
311213	Malt MFG	<10	<10		0.07	
311224	Soybean & Other Oilseed Processing	441	537	96	3.26	1.7%
311225	Fats & Oils Refining & Blending	299	232	-67	1.83	-0.4%
311230	Breakfast Cereal MFG	811	815	4	3.37	0.0%
311340	Nonchocolate Confectionery MFG	102	66	-35	0.17	2.3%
311351	Chocolate & Confectionery MFG from Cacao Beans	37	67	31	0.37	3.0%
311352	Confectionery MFG from Purchased Chocolate	660	572	-88	0.91	0.1%
311411	Frozen Fruit, Juice, & Vegetable MFG	62	191	129	0.33	3.8%
311412	Frozen Specialty Food MFG	2,075	2,209	134	1.94	1.5%
311421	Fruit & Vegetable Canning	418	486	68	0.44	2.8%
311422	Specialty Canning	<10	22		0.10	
311423	Dried & Dehydrated Food MFG	16	<10		0.01	
311511	Fluid Milk MFG	1,114	1,483	369	1.43	2.4%
311512	Creamery Butter MFG	<10	16		0.29	
311513	Cheese MFG	2,437	2,467	31	2.51	-0.8%
311514	Dry, Condensed, & Evaporated Dairy Product MFG	558	623	65	1.80	4.7%
311520	Ice Cream & Frozen Dessert MFG	949	1,034	85	2.52	1.4%
311611	Animal (except Poultry) Slaughtering	5,314	4,242	-1,072	1.56	1.0%
311612	Meat Processed from Carcasses	3,660	6,707	3,047	2.68	2.6%
311613	Rendering & Meat Byproduct Processing	149	225	77	1.52	1.1%
311615	Poultry Processing	7,540	7,337		1.60	-0.2%
311710	Seafood Product Preparation & Packaging	<10	0		0.00	
311811	Retail Bakeries	762	829	67	0.50	-0.1%
311812	Commercial Bakeries	1,873	1,423	-451	0.54	-2.7%
311813	Frozen Cakes, Pies, & Other Pastries MFG	75	0	-75	0.00	
311821	Cookie & Cracker MFG	364	478	114	0.73	1.9%
311824	Dry Pasta, Dough, & Flour Mixes MFG from Purchased Flour	1,053	972	-81	2.37	-1.9%
311830	Tortilla MFG	<10	39		0.11	1.6%
311911	Roasted Nuts & Peanut Butter MFG	25	21	-4	0.07	0.3%
311919	Other Snack Food MFG	246	171	-75	0.21	-1.4%
311920	Coffee & Tea MFG	107	298	192	0.64	1.9%
311930	Flavoring Syrup & Concentrate MFG	160	177	18	0.90	-1.8%
311941	Mayonnaise, Dressing, & Other Prepared Sauce MFG	429	567	138	1.65	3.9%
311942	Spice & Extract MFG	333	430	97	0.91	1.1%
311991	Perishable Prepared Food MFG	184	156	-28	0.15	-0.5%
311999	All Other Miscellaneous Food MFG	1,181	1,168	-12	1.81	0.1%
312111	Soft Drink MFG	1,148	1,086	-62	0.72	-0.1%
312112	Bottled Water MFG	13	44	31	0.14	3.0%
312113	Ice MFG	261	382	121	2.80	1.7%
312120	Breweries	3,052	3,035	-17	1.98	-1.0%
312130	Wineries	784	876	92	0.67	1.2%
312140	Distilleries	329	407	78	1.31	-0.6%
312230	Tobacco MFG	<10	11		0.05	

Source: Economic Modeling Specialists, International (2019.Q4)

Appendix C: Prominent food, agriculture, and forestry occupations

SOC	Occupation	2019 Jobs in Food, Ag., & Forestry	2019 Jobs in Missouri	% of Total MO Occ Emp	Average Annual Openings (19-29) in Food, Ag. & Forestry	Average Annual Openings (19-29) in Missouri	Median Annual Earnings	Age <34	Age 55+	Males % of Occupation	Females % of Occupation
37-3011	Landscaping & Groundskeeping Workers	9,277	16,836	55.1%	1,192	2,239	$29,016	43.9%	19.8%	87.7%	12.3%
51-3092	Food Batchmakers	5,294	6,355	83.3%	765	966	$33,176	36.0%	19.0%	57.1%	42.9%
51-9111	Packaging & Filling Machine Operators & Tenders	5,238	10,506	49.9%	660	1,370	$32,656	33.8%	20.6%	47.1%	52.9%
51-3022	Meat, Poultry, & Fish Cutters & Trimmers	4,105	4,623	88.8%	553	660	$29,702	38.5%	17.6%	66.6%	33.4%
45-2092	Farmworkers & Laborers, Crop, Nursery, & Greenhouse	3,921	4,296	91.3%	644	745	$26,354	42.3%	19.6%	76.2%	23.8%
53-7062	Hand Laborers & Freight, Stock, & Material Movers	3,232	47,227	6.8%	490	7,269	$28,891	45.0%	17.3%	81.4%	18.6%
51-9196	Paper Goods Machine Setters, Operators, & Tenders	2,895	3,409	84.9%	288	367	$43,410	23.7%	25.6%	73.4%	26.6%
51-1011	First-Line Supervisors of Production & Operating Workers	2,265	13,324	17.0%	249	1,487	$56,098	18.7%	26.9%	81.7%	18.3%
53-7051	Industrial Truck & Tractor Operators	2,123	12,479	17.0%	259	1,535	$34,112	36.6%	17.4%	91.9%	8.1%
53-3032	Heavy & Tractor-Trailer Truck Drivers	2,092	45,123	4.6%	248	5,377	$44,034	19.9%	31.7%	95.1%	4.9%
31-9096	Veterinary Assistants & Laboratory Animal Caretakers	2,036	2,285	89.1%	348	410	$26,957	56.9%	11.6%	24.9%	75.1%
41-4012	Sales Reps., Wholesale & MFG, Except Technical & Scientific Products	2,008	25,444	7.9%	222	2,907	$56,888	21.9%	29.8%	75.4%	24.6%
11-9013	Farmers, Ranchers, & Other Agricultural Managers	1,902	1,929	98.6%	158	174	$56,867	19.6%	38.7%	78.4%	21.6%
45-2093	Farmworkers, Farm, Ranch, & Aquacultural Animals	1,835	2,393	76.7%	289	382	$28,080	44.6%	19.2%	76.0%	24.0%
49-9071	General Maintenance & Repair Workers	1,834	28,140	6.5%	200	3,024	$36,150	22.1%	30.1%	96.6%	3.4%
51-9198	Helpers--Production Workers	1,661	6,119	27.2%	274	1,105	$29,266	43.2%	19.8%	73.9%	26.1%
43-6014	Secretaries & Administrative Assistants, Except Legal, Medical, & Executive	1,627	67,517	2.4%	164	6,958	$33,738	22.7%	34.0%	4.4%	95.6%
53-7064	Hand Packers & Packagers	1,599	9,353	17.1%	264	1,559	$24,606	39.6%	19.6%	40.4%	59.6%
11-1021	General & Operations Managers	1,570	46,803	3.4%	143	4,364	$81,494	19.0%	24.9%	71.1%	28.9%
51-7041	Wood Sawing Machine Setters, Operators, & Tenders	1,495	2,083	71.8%	171	261	$24,856	37.3%	20.2%	91.4%	8.6%

SOC	Occupation	2019 Jobs in Food, Ag., & Forestry	2019 Jobs in Missouri	% of Total MO Occ Emp	Average Annual Openings (19-29) in Food, Ag. & Forestry	Average Annual Openings (19-29) in Missouri	Median Annual Earnings	Age <34	Age 55+	Males % of Occupation	Females % of Occupation
29-2056	Veterinary Technologists & Technicians	1,479	1,605	92.2%	146	168	$29,661	53.1%	10.7%	25.5%	74.5%
29-1131	Veterinarians	1,469	1,599	91.9%	76	88	$89,232	20.8%	27.1%	59.0%	41.0%
51-2098	Assemblers & Fabricators, All Other, Including Team Assemblers	1,334	24,982	5.3%	144	3,059	$36,504	34.8%	20.3%	63.8%	36.2%
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	1,297	9,945	13.0%	169	1,233	$39,416	26.8%	28.6%	59.2%	40.8%
51-7042	Woodworking Machine Setters, Operators, & Tenders, Except Sawing	1,261	1,929	65.3%	149	245	$27,893	40.4%	17.4%	85.5%	14.5%
43-9061	General Office Clerks	1,216	42,530	2.9%	150	5,137	$29,869	32.7%	28.6%	17.9%	82.1%
49-3041	Farm Equipment Mechanics & Service Technicians	1,155	1,402	82.4%	111	148	$36,400	29.0%	25.8%	99.1%	0.9%
51-3093	Food Cooking Machine Operators & Tenders	1,132	1,353	83.7%	164	203	$28,683	37.6%	19.3%	63.6%	36.4%
37-1012	First-Line Supervisors of Landscaping, Lawn Service, & Groundskeeping Workers	1,056	1,783	59.2%	108	191	$44,346	27.0%	20.9%	84.5%	15.5%
51-9012	Separating, Filtering, Clarifying, Precipitating, & Still Machine Setters, Operators, & Tenders	991	1,381	71.7%	111	165	$41,267	30.8%	19.3%	88.3%	11.7%
49-9041	Industrial Machinery Mechanics	984	5,040	19.5%	109	578	$52,582	19.9%	29.3%	97.4%	2.6%
43-5071	Shipping, Receiving, & Traffic Clerks	977	11,486	8.5%	106	1,268	$32,906	34.6%	21.4%	70.0%	30.0%
37-3013	Tree Trimmers & Pruners	952	1,153	82.6%	118	147	$42,099	43.9%	17.3%	85.3%	14.7%
43-3031	Bookkeeping, Accounting, & Auditing Clerks	910	29,536	3.1%	104	3,330	$36,774	19.1%	36.1%	12.1%	87.9%
51-9023	Mixing & Blending Machine Setters, Operators, & Tenders	884	2,563	34.5%	121	348	$40,539	30.8%	21.1%	90.2%	9.9%
39-2021	Nonfarm Animal Caretakers	863	4,702	18.4%	146	861	$21,466	61.8%	11.3%	25.3%	74.7%
43-4171	Receptionists & Information Clerks	857	13,994	6.1%	123	2,034	$26,770	44.1%	25.0%	7.6%	92.4%
37-2011	Janitors & Cleaners, Except Maids & Housekeeping Cleaners	847	39,454	2.1%	119	5,515	$25,750	29.0%	29.6%	69.5%	30.5%
45-2091	Agricultural Equipment Operators	846	1,115	75.8%	141	192	$30,992	39.4%	21.2%	80.6%	19.4%
51-3011	Bakers	804	3,800	21.2%	98	556	$24,107	38.4%	22.7%	46.3%	53.7%
53-3033	Light Truck or Delivery Services Drivers	791	17,140	4.6%	91	2,056	$30,493	23.9%	30.7%	93.4%	6.6%
45-2099	All Other Agricultural Workers	763	792	96.4%	123	135	$28,462	43.3%	18.9%	75.3%	24.7%
51-9199	All Other Production Workers	762	6,416	11.9%	93	815	$28,080	34.4%	20.5%	68.9%	31.1%
43-5081	Stock Clerks & Order Fillers	751	35,919	2.1%	104	4,906	$24,690	47.3%	20.6%	64.2%	35.8%
53-7063	Machine Feeders & Offbearers	732	1,763	41.5%	105	255	$27,310	36.1%	22.5%	56.0%	44.0%
51-9011	Chemical Equipment Operators & Tenders	715	3,031	23.6%	72	347	$41,558	24.4%	23.8%	90.0%	10.0%

SOC	Occupation	2019 Jobs in Food, Ag., & Forestry	2019 Jobs in Missouri	% of Total MO Occ Emp	Average Annual Openings (19-29) in Food, Ag. & Forestry	Average Annual Openings (19-29) in Missouri	Median Annual Earnings	Age <34	Age 55+	Males % of Occupation	Females % of Occupation
43-4051	Customer Service Reps.	700	47,828	1.5%	98	6,622	$33,072	42.7%	18.7%	31.9%	68.1%
41-2031	Retail Salespersons	659	80,472	0.8%	98	11,964	$23,442	47.6%	25.1%	46.2%	53.8%
51-3091	Food & Tobacco Roasting, Baking, & Drying Machine Operators & Tenders	650	836	77.8%	80	107	$29,994	31.1%	22.2%	70.0%	30.0%
45-2041	Graders & Sorters, Agricultural Products	650	857	75.9%	96	130	$26,998	29.4%	26.1%	35.2%	64.6%
53-7061	Cleaners of Vehicles & Equipment	630	7,936	7.9%	96	1,253	$23,338	48.8%	17.1%	87.8%	12.2%
51-3023	Slaughterers & Meat Packers	612	693	88.3%	97	122	$29,058	41.1%	16.0%	63.8%	36.2%
53-3031	Driver/Sales Workers	520	9,467	5.5%	55	1,015	$23,504	31.0%	23.8%	93.7%	6.3%
11-3051	Industrial Production Managers	510	3,422	14.9%	42	290	$97,302	13.5%	28.6%	83.8%	16.2%
51-3021	Butchers & Meat Cutters	486	3,337	14.6%	68	451	$32,885	35.1%	25.0%	79.6%	20.4%
45-1011	First-Line Supervisors of Farming, Fishing, & Forestry Workers	462	587	78.7%	70	92	$46,134	18.6%	30.5%	83.0%	16.9%
51-9032	Cutting & Slicing Machine Setters, Operators, & Tenders	441	1,411	31.2%	55	178	$37,731	30.4%	25.5%	78.4%	21.5%
51-3099	All Other Food Processing Workers	440	645	68.3%	57	90	$25,501	33.3%	18.8%	64.5%	35.3%
43-1011	First-Line Supervisors of Office & Administrative Support Workers	436	22,053	2.0%	48	2,365	$54,184	22.5%	27.1%	35.2%	64.8%
49-1011	First-Line Supervisors of Mechanics, Installers, & Repairers	422	7,823	5.4%	41	752	$59,654	15.1%	30.9%	94.0%	6.0%
13-2011	Accountants & Auditors	416	25,473	1.6%	41	2,530	$63,648	28.7%	24.7%	40.9%	59.1%
51-9193	Cooling & Freezing Equipment Operators & Tenders	401	436	91.9%	51	59	$36,317	32.1%	16.1%	72.5%	27.3%
51-9192	Cleaning, Washing, & Metal Pickling Equipment Operators & Tenders	388	689	56.4%	54	99	$28,891	30.0%	21.6%	71.4%	28.6%
49-9043	Machinery Maintenance Workers	383	1,801	21.3%	47	221	$46,342	23.6%	27.8%	96.4%	3.7%
53-1048	First-line Supervisors of Transportation & Material Moving Workers	369	6,423	5.7%	43	759	$54,184	24.5%	25.1%	80.6%	19.4%
41-2022	Parts Salespersons	336	6,118	5.5%	43	829	$30,222	33.1%	29.3%	89.1%	10.9%
41-2011	Cashiers	334	73,293	0.5%	60	13,936	$20,758	60.3%	16.0%	27.4%	72.6%
43-5061	Production, Planning, & Expediting Clerks	322	4,457	7.2%	39	542	$47,382	27.2%	26.2%	45.3%	54.7%
51-5112	Printing Press Operators	307	4,712	6.5%	33	489	$41,413	22.9%	26.3%	77.3%	22.7%
53-7011	Conveyor Operators & Tenders	305	930	32.8%	44	130	$30,347	39.6%	21.6%	85.4%	14.6%

SOC	Occupation	2019 Jobs in Food, Ag., & Forestry	2019 Jobs in Missouri	% of Total MO Occ Emp	Average Annual Openings (19-29) in Food, Ag. & Forestry	Average Annual Openings (19-29) in Missouri	Median Annual Earnings	Age <34	Age 55+	Males % of Occupation	Females % of Occupation
19-4011	Agricultural & Food Science Technicians	304	636	47.7%	35	73	$38,771	34.3%	23.4%	60.5%	39.5%
51-9021	Crushing, Grinding, & Polishing Machine Setters, Operators, & Tenders	296	767	38.6%	37	99	$32,219	30.0%	22.4%	90.6%	9.4%
35-3011	Bartenders	283	11,574	2.4%	45	1,969	$20,093	57.9%	10.9%	44.3%	55.7%
17-2112	Industrial Engineers	277	5,805	4.8%	20	503	$82,950	24.3%	29.7%	81.3%	18.7%
51-7011	Cabinetmakers & Bench Carpenters	275	2,334	11.8%	31	285	$33,342	30.9%	22.8%	95.1%	4.9%
13-1028	Buyers & Purchasing Agents	262	6,822	3.8%	25	658	$58,947	23.2%	30.3%	47.7%	52.3%
35-3031	Waiters & Waitresses	249	47,797	0.5%	46	9,402	$19,074	73.0%	6.6%	30.1%	69.9%
41-3099	All Other Sales Reps., Services, All Other	244	18,867	1.3%	32	2,475	$46,488	33.3%	21.5%	64.2%	35.8%
13-1071	Human Resources Specialists	235	11,845	2.0%	25	1,265	$55,702	33.0%	19.7%	28.2%	71.8%
51-9041	Extruding, Forming, Pressing, & Compacting Machine Setters, Operators, & Tenders	228	1,358	16.8%	32	189	$37,440	27.2%	21.1%	82.7%	17.3%
47-2031	Carpenters	221	13,964	1.6%	23	1,322	$54,371	35.0%	16.7%	98.1%	1.9%
43-5111	Weighers, Measurers, Checkers, & Samplers, Recordkeeping	197	1,506	13.1%	22	160	$28,642	34.9%	24.1%	50.5%	49.5%
41-9011	Demonstrators & Product Promoters	193	1,233	15.7%	35	229	$29,494	33.3%	44.9%	24.7%	75.3%
49-3031	Bus & Truck Mechanics & Diesel Engine Specialists	191	5,763	3.3%	19	607	$44,637	31.6%	23.5%	99.0%	1.0%
47-2111	Electricians	184	11,318	1.6%	21	1,324	$63,294	31.0%	19.2%	97.7%	2.3%
51-4121	Welders, Cutters, Solderers, & Brazers	181	10,126	1.8%	19	1,235	$37,794	36.1%	18.0%	94.2%	5.8%
51-7099	All Other Woodworkers	178	379	46.8%	21	44	$23,795	31.7%	24.5%	92.6%	7.4%
47-2061	Construction Laborers	175	19,872	0.9%	20	2,232	$42,578	42.3%	12.9%	96.5%	3.5%
11-2022	Sales Managers	171	5,304	3.2%	17	538	$123,760	26.9%	19.4%	58.4%	41.6%
35-2021	Food Preparation Workers	165	13,876	1.2%	29	2,483	$20,842	61.2%	14.6%	42.8%	57.2%
37-3012	Vegetation Pesticide Handlers, Sprayers, & Applicators	157	325	48.3%	20	43	$37,482	43.7%	20.9%	88.9%	11.1%
27-1026	Merchandise Displayers & Window Trimmers	154	2,277	6.8%	14	222	$26,874	41.2%	18.6%	46.2%	53.8%
13-1161	Market Research Analysts & Marketing Specialists	147	10,092	1.5%	18	1,325	$56,722	40.4%	14.8%	42.2%	57.8%

SOC	Occupation	2019 Jobs in Food, Ag., & Forestry	2019 Jobs in Missouri	% of Total MO Occ Emp	Average Annual Openings (19-29) in Food, Ag. & Forestry	Average Annual Openings (19-29) in Missouri	Median Annual Earnings	Age <34	Age 55+	Males % of Occupation	Females % of Occupation
51-9191	Adhesive Bonding Machine Operators & Tenders	146	437	33.5%	17	53	$32,864	25.9%	29.1%	57.4%	42.6%
19-1012	Food Scientists & Technologists	143	229	62.6%	17	27	$59,322	30.1%	18.8%	65.1%	34.5%
11-9199	All Other Managers	138	5,572	2.5%	11	479	$93,579	17.9%	29.2%	61.2%	38.8%
51-9121	Coating, Painting, & Spraying Machine Setters, Operators, & Tenders	136	1,753	7.8%	15	213	$33,613	34.8%	17.5%	85.9%	14.1%
35-3022	Counter Attendants, Cafeteria, Food Concession, & Coffee Shop	134	7,699	1.7%	29	1,714	$20,114	79.0%	7.9%	33.0%	67.0%
19-2031	Chemists	132	1,917	6.9%	12	191	$66,830	29.3%	24.1%	62.3%	37.8%
45-4021	Fallers	131	156	84.1%	17	22	$40,019	27.6%	17.9%	93.6%	Insf. Data
41-1012	First-Line Supervisors of Non-Retail Sales Workers	131	4,257	3.1%	12	431	$70,616	21.5%	25.6%	68.0%	32.0%
35-3021	Combined Food Preparation & Serving Workers, Including Fast Food	121	77,457	0.2%	22	15,723	$19,573	68.7%	10.1%	37.8%	62.2%
43-6011	Executive Secretaries & Executive Administrative Assistants	120	10,080	1.2%	10	999	$56,222	22.2%	34.7%	4.5%	95.5%
19-4031	Chemical Technicians	117	944	12.4%	11	99	$50,710	27.9%	26.3%	66.4%	33.5%
49-3053	Outdoor Power Equipment & Other Small Engine Mechanics	115	878	13.1%	13	100	$38,334	32.2%	27.3%	98.5%	1.5%
51-4041	Machinists	113	6,323	1.8%	12	746	$43,472	21.7%	31.9%	95.4%	4.6%
51-8091	Chemical Plant & System Operators	110	372	29.6%	9	38	$68,246	16.9%	25.8%	90.6%	9.4%
13-1081	Logisticians	105	3,170	3.3%	11	347	$68,494	32.3%	20.7%	64.7%	35.3%
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	103	3,501	2.9%	11	373	$49,150	27.4%	24.4%	98.9%	1.1%
13-1151	Training & Development Specialists	103	5,316	1.9%	11	599	$56,430	27.8%	23.1%	39.3%	60.7%
41-4011	Sales Reps., Wholesale & MFG, Technical & Scientific Products	102	5,537	1.8%	11	670	$74,589	23.3%	26.9%	71.8%	28.2%
43-4151	Order Clerks	102	2,717	3.7%	12	328	$32,469	34.0%	26.6%	38.6%	61.4%

Source: Economic Modeling Specialists, International (2019.Q4)

Appendix D: Survey of food, agriculture and forestry employers

SECTION 1: YOUR BUSINESS

Q1: Screening Question:	Count	Percent
I employ workers in the food, agriculture, or forestry industry in the state of Missouri and I am willing to take this voluntary survey on workforce needs for my business.	326	75.8%
I do not employ workers in the food, agriculture, or forestry industry in the state of Missouri.	104	24.2%
Total Respondents	430	100.0%

Q2: Which category *best* describes your business?

	Count	Percentage
Production Agriculture	120	37%
Food & Related Products Manufacturing	92	28%
Agriculture and Forestry Inputs & Support Services	90	28%
Forestry and Wood Products Manufacturing	24	7%
Total	**326**	100%

Q2.1: Production Agriculture

	Count	Percentage
Oilseed and grain farming	34	28%
Vegetable, fruit, tree nut, and melon farming	24	20%
Beef cattle production	19	16%
Greenhouse, nursery, and floriculture production	10	8%
Swine production	10	8%
All other crop farming (hay, etc.)	7	6%
Poultry and egg production	4	3%
Postharvest Crop Activities (except Cotton Ginning)	3	3%
Dairy cattle and milk production	2	2%
Support activities for agriculture	3	3%
Farm Machinery and Equipment Manufacturing	1	1%
Other animal production	1	1%
Support Activities for Forestry	2	2%
Total	**120**	**100%**

Q2.2: Forestry and Wood Products Manufacturing

	Count	Percentage
Wood product manufacturing	8	33%
Sawmills	7	29%
Forestry products manufacturing	4	17%
Forestry, forest products, and timber tract production	3	13%
Commercial logging	2	8%
Total	**24**	**100%**

Q2.3: Food and Related Products

	Count	Percentage
Animal slaughter and meat processing	41	45%
Fruit and vegetable manufacturing	9	10%
Dairy product manufacturing	6	7%
Wineries	5	5%
Breweries	3	3%
Bread and bakery products	2	2%
Distilleries	2	2%
Dog and cat food manufacturing	2	2%
Poultry processing	2	2%
Flour milling	1	1%
Rice Milling	1	1%
Soybean or oilseed processing	1	1%
All other food manufacturing	17	18%
Total	**92**	**100%**

Q2.4: Agriculture and Forestry Inputs & Support Services

	Count	Percentage
Veterinary services	15	17%
Fertilizer, pesticide, or chemical manufacturer or dealer	14	16%
Feed milling	7	8%
Farm Supplies Merchant Wholesalers	5	6%
Farm, forest, or food product machinery manufacturing	3	3%
Landscaping Services	4	4%
Farm and Garden Machinery/Equipment Wholesalers	2	2%
Farm Machinery and Equipment Manufacturing	1	1%
Food Product Machinery Manufacturing	1	1%
Transportation and storage	1	1%
Other (please describe):	37	41%
Total	**90**	**100%**

Section 2: Your Current Workforce

Q3: Where does the majority of your workforce work?

299 respondents answered this question. One of these respondents reported that their workforce was dispersed across the state (selected all counties) and one selected 109 counties—these respondents are not included in the table. Most (245) selected just one county. The other 51 respondents to this question selected between 2 and 29 separate counties. Percentages are calculated out of 299 total respondents. (Counties with no respondents are shaded.)

County	Count	Percent
Adair	9	3.0%
Andrew	2	0.7%
Atchison	0	0.0%
Audrain	9	3.0%
Barry	5	1.7%
Barton	3	1.0%
Bates	5	1.7%
Benton	4	1.3%
Bollinger	1	0.3%
Boone	20	6.7%
Buchanan	9	3.0%
Butler	3	1.0%
Caldwell	0	0.0%
Callaway	9	3.0%
Camden	5	1.7%
Cape Girardeau	5	1.7%
Carroll	5	1.7%
Carter	0	0.0%
Cass	3	1.0%
Cedar	1	0.3%
Chariton	5	1.7%
Christian	2	0.7%
Clark	2	0.7%
Clay	2	0.7%
Clinton	1	0.3%
Cole	8	2.7%
Cooper	9	3.0%
Crawford	2	0.7%
Dade	4	1.3%
Dallas	0	0.0%
Daviess	0	0.0%
De Kalb	0	0.0%
Dent	5	1.7%
Douglas	1	0.3%
Dunklin	3	1.0%
Franklin	12	4.0%
Gasconade	12	4.0%
Gentry	0	0.0%
Greene	7	2.3%
Grundy	3	1.0%
Harrison	1	0.3%
Henry	0	0.0%
Hickory	1	0.3%
Holt	0	0.0%
Howard	6	2.0%
Howell	4	1.3%
Iron	2	0.7%
Jackson	12	4.0%
Jasper	7	2.3%
Jefferson	7	2.3%
Johnson	8	2.7%
Knox	1	0.3%
Laclede	5	1.7%
Lafayette	12	4.0%
Lawrence	3	1.0%
Lewis	7	2.3%
Lincoln	5	1.7%
Linn	9	3.0%
Livingston	5	1.7%
Macon	10	3.3%
Madison	1	0.3%
Maries	2	0.7%
Marion	6	2.0%
McDonald	2	0.7%
Mercer	0	0.0%
Miller	3	1.0%
Mississippi	2	0.7%
Moniteau	5	1.7%
Monroe	6	2.0%
Montgomery	8	2.7%
Morgan	5	1.7%
New Madrid	2	0.7%
Newton	3	1.0%
Nodaway	8	2.7%
Oregon	0	0.0%
Osage	2	0.7%
Ozark	1	0.3%
Pemiscot	1	0.3%
Perry	3	1.0%
Pettis	2	0.7%
Phelps	1	0.3%
Pike	5	1.7%
Platte	1	0.3%
Polk	1	0.3%
Pulaski	2	0.7%
Putnam	3	1.0%
Ralls	4	1.3%
Randolph	12	4.0%
Ray	1	0.3%
Reynolds	1	0.3%
Ripley	1	0.3%
Saline	8	2.7%
Schuyler	4	1.3%
Scotland	5	1.7%
Scott	4	1.3%
Shannon	13	4.3%
Shelby	6	2.0%
St. Charles	9	3.0%
St. Clair	5	1.7%
St. Francois	2	0.7%
St. Louis	3	1.0%
St. Louis City	5	1.7%
Ste. Genevieve	4	1.3%
Stoddard	6	2.0%
Stone	5	1.7%
Sullivan	4	1.3%
Taney	1	0.3%
Texas	5	1.7%
Vernon	3	1.0%
Warren	7	2.3%
Washington	3	1.0%
Wayne	1	0.3%
Webster	1	0.3%
Worth	0	0.0%
Wright	5	1.7%

Q4: How do you expect the size of your business's workforce to change over the next 12 months?

	Count	Percentage
Increase significantly	17	5.6%
Increase slightly	132	43.1%
Remain the same	130	42.5%
Decrease slightly	14	4.6%
Decrease significantly	5	1.6%
Not sure	8	2.6%
Total	306	100.0%

Q5: How many workers do you employ in the state of Missouri?

Minimum	Maximum	Mean	Median	Count
0	2,900	89	9	431

Q6: What percent of your employees are seasonal?

	Count	Percentage
None	160	52.1%
1 – 25%	69	22.5%
26 – 50%	14	4.6%
51 – 75%	14	4.6%
>75%	50	16.3%
Total	307	100.0%

Q7: How physically demanding is the average job in your business?

	Count	Percentage
Intensely physically demanding	27	8.8%
Moderately physically demanding	178	57.8%
Occasionally physically demanding	92	29.9%
Not physically demanding	11	3.6%
Total	308	100.0%

SECTION 3: VACANCIES & JOB GROWTH

Q8: How does your business plan to add employees?

	Count	Percentage
Hiring new full-time employees	157	55.3%
Hiring new part-time employees	137	48.2%
Other methods to add workers	31	10.9%
Hiring contract workers	26	9.2%
Using a temporary agency	21	7.4%
Recalling workers from lay-off list	14	4.9%

Note: Percentages out of 284 who selected at least one response (will not add up to 100%)

Q9: Which of the following are potential barriers to expanding employment within the business?

	Count	Percentage
Shortage of workers with knowledge or skills	210	71.4%
Economic conditions	111	37.8%
Government policies or regulations	67	22.8%
Not looking to expand	35	11.9%
Lack of transportation access	27	9.2%
Lack of childcare access	22	7.5%
Shortage of available training programs	21	7.1%
No barriers to expanding	13	4.4%
Lack of information	10	3.4%

Note: Percentages out of 294 who selected at least one response (will not add up to 100%)

Q10: How has the business adapted to a lack of skilled job applicants?

	Count	Percentage
Forced to hire less experienced workers and then train them	223	78.0%
Offering increased wages due to shortage of experienced workers	106	37.1%
Investing in automation	54	18.9%
Hiring from outside the area	45	15.7%
Hiring contractors	31	10.8%
No lack of skilled applicants	27	9.4%
Hiring from outside the United States	16	5.6%

Note: Percentages out of 286 who selected at least one response (will not add up to 100%)

Q11: What is the most common reason workers leave positions at your business?

	Count	Percentage
Higher compensation/benefits from other employers	71	25.1%
Workers rarely leave	59	20.8%
Seeking different type of work activities	50	17.7%
Desire for more flexible or regular schedule	31	11.0%
The job is too physically demanding	29	10.2%
Other (please describe):	23	8.1%
Retirement	20	7.1%
Total	283	100.0%

Q12: What critical positions are the *most difficult to fill*?

All Survey Responses	Count	Percentage
Mechanics/welders/maintenance/technicians and other skilled positions	35	11%
Line workers/production line/slaughters and meat cutters	34	10%
General labor/physical/unskilled work	28	9%
CDL & Equipment operators	26	8%
General farm labor	22	7%
Management	16	5%
Customer service/sales	13	4%
Specialists (Engineers, plant scientists, foresters, etc.)	12	4%
Applicator	10	3%
None	10	3%
Animal/livestock handling	7	2%
Specific time/shift related	7	2%
Chefs/cooks/kitchen/food prep	6	2%
Fermentation	6	2%
Veterinarians & veterinarian technicians	6	2%
Accounting/clerical	5	2%
No response	83	25%
Total	**326**	**100%**

Q24A: What critical positions are the most difficult to fill? *Common responses among three largest surveyed industry groups.*

Q12.A1: Production Agriculture

	Count	Percentage
Farm production general labor	19	16%
CDL & Equipment operators	11	9%
Mechanics/welders/maintenance/technicians	8	7%
Management	7	6%
Animal/livestock handling	6	5%
Customer service/sales	6	5%
General labor/physical/unskilled work	6	5%
Other	18	15%
(blank)	39	33%
Total	**120**	**100%**

Q12.A2: Food & Related Products Manufacturing

	Count	Percentage
Line workers/production line/meat cutters	20	22%
Mechanics/welders/maintenance/technicians and other skilled positions	15	16%
Slaughter	10	11%
Fermentation	6	7%
Customer service/sales	5	5%
Other	20	22%
(blank)	16	17%
Total	**92**	**100%**

Q12.A3: Agriculture and Forestry Inputs & Support Services

	Count	Percentage
CDL & Equipment operators	10	11%
Specialists (Engineers, plant scientists, foresters, etc.)	8	9%
Applicator	6	7%
Management	6	7%
Mechanics/welders/maintenance/technicians	6	7%
Veterinarian technicians & Veterinarians	6	7%
Other	25	28%
(blank)	23	26%
Total	**90**	**100%**

Q13: What critical positions will be most affected by an aging workforce?

All industries	Count	Percentage
Production/physical labor	64	20%
Production/skilled labor	25	8%
None	21	6%
CDL & Equipment operators	18	6%
Management	17	5%
Mechanics/welders/maintenance/technicians	14	4%
Slaughter	9	3%
All jobs	8	2%
Relationships/networks/experience/knowledge	8	2%
Work ethic	7	2%
Animal/livestock handling	6	2%
Applicator	6	2%
Veterinarian technicians & Veterinarians	6	2%
Product development	5	2%
Fermentation	4	1%
Accounting/clerical	3	1%
Specific time/shift related	3	1%
Customer service/sales	2	1%
(blank)	100	31%
Total	**326**	**100%**

Q13A: What critical positions will be most affected by an aging workforce?
Common responses among three largest surveyed industry groups.
Q13A.1: Production Agriculture

Production Agriculture	Count	Percentage
Production/physical labor	30	25%
CDL & Equipment operators	9	8%
None	9	8%
Management	6	5%
Mechanics/welders/maintenance/technicians	6	5%
Other	23	19%
(blank)	37	31%
Total	**120**	**100%**

Q13A.2: Food & Related Products Manufacturing

	Count	Percentage
Production/physical labor	18	20%
Slaughter	9	10%
Production/skilled labor	8	9%
None	7	8%
Other	22	24%
(blank)	28	30%
Total	**92**	**100%**

Q13A.3: Agriculture and Forestry Inputs & Support Services

	Count	Percentage
Production/physical labor	9	10%
Production/skilled labor	8	9%
Management	7	8%
Veterinarian technicians & Veterinarians	6	7%
Other	29	32%
(blank)	31	34%
Total	**90**	**100%**

SECTION 4: RECRUITMENT & RETENTION STRATEGIES

Q14: What recruitment practices do you use to fill current jobs?

	Count	Percentage
Employee referrals and networks	229	81.8%
Social Media sites (LinkedIn, Facebook, etc.)	151	53.9%
College/university recruiting	76	27.1%
Advertise on the business website	74	26.4%
Advertise at job centers	52	18.6%
Industry specific job boards (Hansen Agriplacements, AgCareers.com, etc.)	45	16.1%
External recruiters and agencies	39	13.9%
Other (please describe):	39	13.9%
Billboards and door signs	28	10.0%
Work with the media to talk about our business/events	21	7.5%

Note: Percentages out of 280 who selected at least one response (will not add up to 100%)

Q15: Which, if any, of the following benefits or incentives does your business offer employees?

	Count	Percentage
Paid vacation	168	58.7%
Performance based pay increases or bonuses	152	53.1%
Flexible work schedule	148	51.7%
Other (please describe):	74	25.9%
Financially support continuing education	55	19.2%
Providing housing or a vehicle	46	16.1%
The ability to work remotely	29	10.1%
Childcare	1	0.3%

Note: Percentages out of 286 who selected at least one response (will not add up to 100%)

Q16: Does your business hire, or would you consider hiring, the following workers?

	Count	Percentage
Veterans	242	85.5%
Recent retirees	182	64.3%
High school students	179	63.3%
Interns or co-ops	178	62.9%
Ex-offenders	127	44.9%
H-2A guest workers	81	28.6%
None of the above	4	1.4%

Note: Percentages out of 283 who selected at least one response (will not add up to 100%)

Q17: What does your business do to promote careers in food, agriculture, and/or forestry to youth?

	Count	Percentage
Work with 4-H, FFA or other youth groups	174	61.1%
Provide facility tours	138	48.4%
Speak in schools	118	41.4%
Social media campaign	90	31.6%
None of the above	42	14.7%
Other (please describe):	27	9.5%

Note: Percentages out of 285 who selected at least one response (will not add up to 100%)

SECTION 5: SKILLS & TRAINING NEEDS

Q18: What skills are most difficult to find?

	Count	Percentage
Reliability & general work readiness	139	51.1%
Leadership & supervisor skills	97	35.7%
Problem solving & analytical	91	33.5%
Truck drivers	69	25.4%
Customer service & sales	66	24.3%
Communication & interpersonal skills	57	21.0%
Livestock handling	55	20.2%
Heavy equipment operation	48	17.6%
Other	44	16.2%
Automotive repair & mechanical	35	12.9%
Agronomy	35	12.9%
Electrical	34	12.5%
Animal husbandry	31	11.4%
Financial management	23	8.5%
Automation & robotics knowledge	22	8.1%
Programming & software applications	19	7.0%

Note: Percentages out of 272 who selected at least one response (will not add up to 100%)

Q19: Which of the following methods does your business use to increase the skills of current workers?

	Count	Percentage
On-the-job training	265	95.0%
Flexible schedule for continuing education	70	25.1%
In-house classroom training	67	24.0%
Vendor training	63	22.6%
Online courses	59	21.1%
Apprenticeship programs	49	17.6%
Tuition reimbursement	45	16.1%
Community College provided customized training or education	27	9.7%
Hire only workers who are already trained	21	7.5%
Vocational trainings	21	7.5%
Other, please describe:	12	4.3%
None of the above	3	1.1%

Note: Percentages out of 279 who selected at least one response (will not add up to 100%)

Q20: What training methods do you feel are most effective?

	Count	Percentage
On-the-job training	274	97.2%
Apprenticeship programs	52	18.4%
In-house classroom training	46	16.3%
Vendor training	46	16.3%
Vocational trainings	44	15.6%
Flexible schedule for continuing education	41	14.5%
Hire only workers who are already trained	31	11.0%
Community College provided customized training or education	31	11.0%
Online courses	30	10.6%
Tuition reimbursement	18	6.4%
Other, please describe:	6	2.1%
None of the above	2	0.7%

Note: Percentages out of 282 who selected at least one response (will not add up to 100%)

Q21: What challenges do you face when providing training for your existing workforce?

	Count	Percentage
Lack of time for in-service training	157	62.8%
Finding relevant training options	103	41.2%
Fear of losing trained employees	74	29.6%
Can't afford existing training options	31	12.4%
Lack of online training options	31	12.4%
Lack of space for training	17	6.8%
Other (please describe):	16	6.4%
Poor experience with previous training providers	14	5.6%

Note: Percentages out of 250 who selected at least one response (will not add up to 100%)

SECTION 6: TECHNOLOGY ADOPTION AND AUTOMATION

Q22: Which of the following best describes your business leadership's feelings about internal process automation?

	Count	Percentage
We are already making significant investments in automation	69	25.6%
Automation has significant potential for our business and we are planning to make investments in automating our processes	47	17.4%
Automation is on our radar, but we have no current plans to invest in it	52	19.3%
We are not looking to automate our processes	102	37.8%
Total	**270**	**100.0%**

Q23: How is greater automation impacting jobs within your business?

	Count	Percentage
We don't automate	79	29.3%
Changed the type of jobs we hire (e.g., more technically skilled or more educated)	73	27.0%
No effect	69	25.6%
We need to provide our workers with more on the job training	54	20.0%
Decreased the number of jobs	52	19.3%
Increased the number of jobs	17	6.3%

Note: Percentages out of 270 who selected at least one response (will not add up to 100%)

Q24: What barriers does your business face as you adopt new technology and processes?

	Count	Percentage
Cannot afford to implement	105	40.2%
Insufficient broadband capacity	92	35.2%
No barriers	56	21.5%
Workforce lacks capacity to implement automated processes	55	21.1%
Lack of information about available technologies	42	16.1%
New technologies are not applicable	39	14.9%
Other (please describe):	20	7.7%

Note: Percentages out of 261 who selected at least one response (will not add up to 100%)

Q25: What specific jobs have been most impacted by changing technologies or automation in your business?

	Count	Percentage
Manual Labor	24	7.3%
Equipment Operator	15	4.6%
Technical/IT	14	4.3%
Office/Admin	12	3.7%
Packaging	11	3.4%
Production machine operators	11	3.4%
Meat Processor	7	2.1%
Maintenance	6	1.8%
Service	4	1.2%
Crop Scouting	3	0.9%
Manager	1	0.3%
N/A	32	9.8%
(blank)	187	57.2%
Total	**327**	**100.0%**

Q26: What is your businesses top workforce priority over the next ten years?

	Count	Percentage
Hiring capable and reliable staff	43	13.1%
Hiring for critical positions and specific skills	35	10.7%
Retention	29	8.9%
Business growth and/or sustainability	27	8.3%
Skills and Training	23	7.0%
Automation and Technology	14	4.3%
Aging workforce and/or succession planning	12	3.7%
Other Business Concerns	11	3.4%
NA	5	1.5%
(blank)	128	39.1%
Total	**327**	100.0%

Appendix E: Completers by Program

E1: 2018 COMPLETIONS AT MISSOURI-BASED INSTITUTIONS BY CLASSIFICATION OF INSTRUCTIONAL PROGRAM (CIP) CODES

CIP Code	Description	All completions (2018)	MO Fast Track Eligible
01.0000	Agriculture, General	121	Y
01.0101	Agricultural Business and Management, General	136	Y
01.0102	Agribusiness/Agricultural Business Operations	136	Y
01.0103	Agricultural Economics	21	Y
01.0199	Agricultural Business and Management, Other	15	Y
01.0201	Agricultural Mechanization, General	56	N
01.0307	Horse Husbandry/Equine Science and Management	3	N
01.0309	Viticulture and Enology	3	N
01.0507	Equestrian/Equine Studies	22	N
01.0601	Applied Horticulture/Horticulture Operations, General	18	Y
01.0607	Turf and Turfgrass Management	24	Y
01.0802	Agricultural Communication/Journalism	14	Y
01.0901	Animal Sciences, General	242	N
01.1001	Food Science	21	N
01.1101	Plant Sciences, General	106	N
01.1102	Agronomy and Crop Science	45	N
01.1103	Horticultural Science	35	N
03.0101	Natural Resources/Conservation, General	53	N
03.0103	Environmental Studies	78	N
03.0104	Environmental Science	82	N
03.0201	Natural Resources Management and Policy	21	N
03.0501	Forestry, General	14	N
03.0506	Forest Management/Forest Resources Management	1	N
03.0510	Forest Resources Production and Management	11	N
03.0511	Forest Technology/Technician	3	N
03.0601	Wildlife, Fish and Wildlands Science and Management	55	N
13.1301	Agricultural Teacher Education	59	Y
51.0808	Veterinary/Animal Health Technology/Technician & Vet. Ass't	75	Y
51.1104	Pre-Veterinary Studies	3	N
51.2401	Veterinary Medicine	110	N
51.2501	Veterinary Sciences/Veterinary Clinical Sciences, General	11	N
51.2505	Veterinary Pathology and Pathobiology	6	N

Source: Economic Modeling Specialists International; NCES IPEDS; Missouri DHEWD

E2: 2018 COMPLETIONS OF AGRICULTURE, NATURAL RESOURCES, AND VETERINARY MEDICINE PROGRAMS AT MISSOURI-BASED INSTITUTIONS BY DEGREE TYPE

Institution	All completions	Award of < 1 academic year	Award of at least 1 but < 2 academic years	Associate's Degree	Bachelor's Degree	Postbac. certificate	Master's Degree	Doctor's Degree
University of Missouri-Columbia	612				382	11	78	141
Missouri State University-Springfield	205				191		14	
Northwest Missouri State University	148		0		144		4	
Southeast Missouri State University	97				90		7	
Webster University	54				0	2	52	
College of the Ozarks	46				46			
Crowder College	39			39				
North Central Missouri College	28	16		12				
Washington University in St Louis	28				28			
Ozarks Technical Community College	27		8	19				
Metropolitan Community College-KC	26	5		21				
Lincoln University	25				18		7	
University of Missouri-Kansas City	24				24			
Midwest Institute	22			22				
State Technical College of Missouri	21		9	12				
William Woods University	21				21			
Columbia College	20			14	6			
University of Central Missouri	19				19		0	
Truman State University	18				18	0		
Saint Louis Community College	16		7	9				
Missouri Western State University	16				16			
Jefferson College	14			14				
Missouri State University-West Plains	13	1	0	12				
State Fair Community College	12	0	1	11				
Saint Louis University	9				9			
Three Rivers College	7			7				
Mineral Area College	7		0	7				
Missouri Valley College	6				6			
Stephens College	4				4			
Westminster College	3				3			
Central Methodist University	3				3			
Evangel University	3				3			
Maryville University of Saint Louis	2				2			
Lindenwood University	1				1			
Drury University	1				1			
Cottey College	1				1			
Drury University-Coll. of Con't Prof. Studies	1				1			
Cape Girardeau Career & Tech. Center	1		1					

Source: Economic Modeling Specialists International; NCES IPEDS


Extension
University of Missouri

MISSOURI
dept. of
Agriculture

Missouri
Agricultural Foundation

MASBDA
MISSOURI AGRICULTURAL AND
SMALL BUSINESS DEVELOPMENT AUTHORITY